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FEEDLOT FINISHING OF CATTLE AND SHEEP IN THE IRRIGATED AREAS OF SOUTHERN ALBERTA

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Feedlot finishing is an integral part of the sugar beet and vegetable canning industries.

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PREFACE

Most farmers in the irrigated areas of southern Alberta realize the importance of livestock in their general production program to assist in maintaining high soil fertility and satisfactory soil texture. High land values, intensively cultivated crop production, and the need for distributing labor throughout the year has indicated that the winter feeding of livestock, generally fits into the irrigated farm program better than year-round livestock production. Winter feeding provides for optimum utilization of the by-products of crop production in the feeding program and concentrates the manure so that distribution can be controlled to crop land from which the greatest immediate cash returns may be obtained.

The first issue of this bulletin in 1947 attempted to bring together the available information on the many questions with which the livestock feeder is confronted. This, the second issue, has the same object in mind, and in fact has been changed very little. However, more has been learned during the past 10 years concerning the relative value of certain feeds and feeding practices and new feeds have been introduced. This new information has been added.

The art of livestock feeding, like other arts, cannot be circumscribed entirely by rules and recommendations but is learned best through experience and keen observation. However, livestock feeding is also a science that can be learned only through a knowledge of the nutritional requirements of various classes and ages of livestock and the extent to which the various feedstuffs available meet these requirements. The feeders who make full use of home-grown feeds, and who follow the recommendations on feeding and management outlined in this bulletin will find that feedlot finishing yields a satisfactory return on investment. It is a foregone conclusion that feedlot finishing will not be equally profitable every year and under all conditions, in fact losses may occur in some years. Because of these fluctuations, livestock finishing must be looked upon as a permanent venture and not an in-and-out business, so that any losses that might be incurred in unfavorable years may be made good in the better years.

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FEEDLOT FINISHING OF CATTLE AND SHEEP IN THE IRRIGATED AREAS OF SOUTHERN ALBERTA

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INTRODUCTION

The winter finishing of lambs and cattle in the irrigated sections of southern Alberta has grown during the past thirty years to the status of a major industry. The development of this industry has been gradual but steady. During the period of development many changes have taken place in such factors as type and age of stock fed, finished weight, length of feeding period, ration fed, and methods of feeding.

The introduction of irrigation farming in southern Alberta led to the development of a more intensive type of agriculture in which the production of alfalfa hay formed an important part of the farm enterprise. However, farmers in these districts often found themselves in possession of quantities of hay for which there was only a limited market. Coincidental with this situation there usually was available a large number of unfinished cattle and sheep from the adjoining range areas for which there was often a restricted market. It was not long before certain enterprising individuals realized the possibilities of putting these factors together for the mutual benefit of the farmer and the rancher. Later the need for livestock to produce manure for maintaining soil fertility became evident and livestock feeding gained wide acceptance. Finally the possibilities of converting non-saleable by-products into a cash value product in the form of lamb or beef became evident. All three of these factors are now considered important in addition to the actual profits derived from the feeding operations.

In the pioneer days of feedlot finishing, alfalfa hay formed the main feed and in many cases it was the only feed. Two-year-old and older cattle and yearling sheep formed the principal types of stock fed. It was not long before the feeder realized the advantage of grain in the fattening ration. At about the same time, influenced largely by the demand for smaller cuts of meat, the emphasis swung from finishing mature stock to the finishing of calves and yearling cattle and spring lambs. However, the feeding of two-year-old cattle and cows is still popular with many feeders.

With the introduction of the sugar beet factories, and later the vegetable canning factories, many by-products became available. The disposal of these by-products was at first a serious problem with many tons going to waste each year before the feeder realized the high value of these products in the livestock fattening ration. To-day these by-products form the major part of the ration in the areas adjacent to the factories and in some cases the demand exceeds the supply. In the earlier days of the feeding industry in southern Alberta a large part of the sugar beet by-products was fed by what may be termed commercial feeders who built their feedlots close to the sugar factories, bought

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most of their feeds, and made little if any use of the manure. In recent years a larger percentage of these by-products is being fed by the beet growers themselves as they are becoming aware of the value of a livestock feeding program in supplying the much-needed manure for use on their land.

The growth and importance of the livestock fattening industry in irrigated areas of southern Alberta is attested by the fact that during the winter of 1954-55 over 60,000 head of cattle and 100,000 head of ewes and lambs were finished in the feedlots. In addition to added revenue, these animals produced thousands of tons of manure of inestimable value. This development would seem a logical one in view of the need for farmyard manures, the large supply of bulky feeds available which can be disposed of profitably only through livestock feeding, and a readily available supply of unfinished cattle and lambs.

BUYING AND SELLING FEEDER STOCK

The fattening of purchased cattle and sheep is a speculative and specialized business. It requires sound business judgment and a complete knowledge of the many factors that influence the returns to be expected from investments and labor. The buying of feeder livestock at a price that will permit a fair margin for feeding, the financing of the investment at a minimum cost, and the selling of the finished animals at top market prices are factors of paramount importance to successful and profitable feedlot finishing.

A man may be a skillful feeder but lose money year after year because of poor judgment in buying and selling. For this reason the inexperienced feeder would be well advised to seek the assistance of a man or organization experienced in the selection and buying of feeder stock. This will help ensure the purchase, at a favorable price, of stock that will best meet his need in relation to the type of feed he has on hand, the facilities on his farm for feeding, and his previous experience.

The auction system of buying and selling cattle has increased in popularity within recent years in Alberta. Under this system the buyer or seller is assured that he is paying or receiving a competitive price in accordance with local market demands. The inexperienced feeder would be well advised to attend a few feeder sales before purchasing his requirements to become acquainted with market demands for various grades and ages of feeder stock.

The financing of the investment in livestock must be given careful consideration. Few farmers have sufficient capital reserves with which to finance the purchase of feeder stock and must depend on borrowed capital for this purpose. In the pioneer days of livestock finishing in southern Alberta some farmers fattened livestock under contract with the ranchers and thus required no capital outlay for stock. A few farmers were able to do their own financing and bought their feeder animals outright but a large majority of farmers were prevented from feeding because of lack of sufficient capital. However, about 1936 there came into being the Livestock Feeders' Associations sponsored by the Alberta Department of Agriculture. Under the Feeder Association policy groups of feeders organized into Feeder Associations and receive financial backing and assistance in the purchasing and selling of feeder and finished cattle and sheep as well as advice on feeding and management. These Associations have been an important factor in the rapid expansion of feedlot finishing in Alberta. While selling is not quite so speculative as buying it must be given careful consideration as it may be the deciding factor in whether or not the feeder makes a profit on his work and investment. If the feeder is to obtain maximum profits he must carefully study current market trends, the premium being paid for well finished stock, and the increasing costs of gains as the feeding

period advances. In selling as in buying the inexperienced feeder should seek the assistance of an experienced man who can advise him when best to sell. As mentioned previously the Feeder Associations provide this service. Other co-operative organizations, commission firms and private dealers also render services in the buying and selling of feeder and finished stock.

Figure 1.—The auction system of buying and selling offers many advantages to the inexperienced cattle feeder over the private barter system.

The type, breeding, age, and sex of the feeder stock, the amount and combination of feeds fed, and the care and management that the stock receive are important considerations in fattening livestock. These factors will be discussed in detail in the following pages.

CLASS OF STOCK TO FEED

The decision of the feeder as to which class or classes of stock he should feed (cattle, sheep, or both) may be influenced by one or many factors. His like or dislike for a certain class of stock, his previous experience, and the facilities and feeds that he has available on his farm may be the deciding factors. The availability of a good supply of feeder cattle or sheep and the length of time that he has available for feeding are other factors that may influence his decision. Sheep usually can be finished in 100 days while cattle require from 90 to 200 days depending on the age of cattle. Both cattle and sheep require much the same feeds and an equal amount of care and equipment. However, cattle, especially mature cattle, are better suited than sheep to the utilization of low quality feeds. Two-year-old and long-yearling cattle can be finished successfully on a limited amount of grain if plenty of time is allowed and good quality hay is provided, whereas baby beeves and lambs seldom reach a good market finish at the desired weight unless fed a liberal amount of grain. No

general statement can be made regarding the relative profitableness of sheep and cattle as both have returned large profits in certain years and equally heavy losses in other years.

Once having decided upon the class of stock to feed, it is not a wise policy to change from one to the other every few years unless market conditions or feed supply warrants such a change for each class of stock will return greater profits as more experience is gained through feeding them. Furthermore, feedlots and feedlot equipment suitable for cattle are not readily converted to accommodate sheep, and likewise, sheep feedlots are not suitable for cattle feeding.

MARGIN

The margin or spread between the total cost per 100 pounds of the feeder cattle or lambs and the selling price per 100 pounds of fattened stock largely determines the profit or loss in the livestock fattening business. For this reason the feeder should consider carefully the main factors that determine the margin required in any year to cover all costs of the feeding operation. Usually the feed costs of putting on 100 pounds of gain is greater than the selling price per 100 pounds of finished animal. Therefore, in order to make a profit a higher price per 100 pounds must be secured for the cattle or lambs when marketed than the original cost per 100 pounds as feeders. The profit in fattening livestock is not obtained from the additional weight put on in the feedlot but from the increased value of the initial weight of the feeder stock.

No definite rule can be stated with regard to the size of the margin required to assure a profit as many factors enter into this question. Some of these factors are:—

(1) Initial weight of the feeder stock. The more an animal weighs when placed on feed, other conditions being equal, the less is the margin required. The reason is that the increased selling price applies to a greater number of pounds of initial weight.

(2) Feed prices. The higher the price of feed in relation to livestock prices the greater the margin must be to cover the cost of feeding. Conversely, if livestock prices are high in relation to feed prices a smaller margin is necessary.

(3) Quality of feeder stock. Good quality feeder stock usually can be more profitably fed on a smaller margin than poor quality feeders because they normally require less feed per 100 pounds of gain.

(4) Suitability of ration and managerial practises. The feeder who provides balanced rations and who feeds and manages his stock efficiently will be able to feed profitably on a smaller margin than the less efficient livestock feeder.

(5) Degree of finish. Feed costs per 100 pounds of gain increase when animals are carried to a high degree of slaughter finish and, therefore, a larger margin is necessary if they are to be highly finished.

The margin must be sufficient to cover the cost of transportation of the feeder animals to the feedlot and the finished animals to the point of sale, all labor costs, bedding, interest on the investment, and death losses that occur in the feedlot. Experience has shown that the normal death loss with feedlot lambs will be between 2 and 3 per cent, with calves between 1 and 2 per cent, and yearlings and older cattle about 1 per cent. With good care and management death losses can be reduced.

From a study of current market prices and market trends of feeder and finished stock the feeder can determine to his own satisfaction whether he has a reasonable chance to make a profit from feeding in any one year. It is a foregone conclusion that few farmers will feed if they expect to suffer a heavy loss. However, many farmers will feed even if they anticipate no large profits because they realize the value of the resulting manure in increasing future

crop yields. Depreciation on the feedlot and feedlot equipment, even if they are not being used, and the sales value of hay, grain, and other farm feeds if not marketed through livestock are factors to consider before deciding not to feed.

Figure 2.—A good type of yearling feeder steer.

Figure 3.—The same steer as in Fig. 2 after three months' feeding. This steer gained over two pounds daily while on feed and when slaughtered was graded a "Red Brand" carcass.

FACTORS TO CONSIDER WHEN PURCHASING AND FEEDING CATTLE

Type and Breeding of Feeder Cattle

As a general rule the blocky type of feeders with good weight for age and of good beef breeding will make the most economical gains. They are usually the more profitable to feed if their cost is not considerably higher than that of the common feeders. In experiments conducted for 3 years (1938-39 to 1940-41) by the United States Department of Agriculture to determine which grades of feeder cattle were the most profitable to feed, it was found that "Good" grade feeder steers made significantly greater gains than "Common" grade feeders in both an 84-day and a 140-day feeding period on an average of approximately 18 per cent less feed per 100 pounds gain in the 84-day feeding period and 6 per cent less feed in the 140-day feeding period. However, common grade feeders often return a larger profit for feeding than do good quality feeders because of the greater spread between feeder and slaughter price of common feeders as compared with choice feeders. The higher grade feeder cattle that carry considerable grass finish are often in demand during the fall months by the packers and butchers for immediate slaughter, resulting in prices too high to give the feeder sufficient margin for fattening them.

Thin feeder cattle of good breeding and in good health will make rapid and economical gains if properly fed and cared for. A greater knowledge of the nutritional requirements of livestock is required in feeding thin cattle than in feeding cattle that carry considerable grass finish. This is because thin cattle often are unthrifty or suffering from certain nutritional deficiencies that must be corrected before they will make rapid gains. Thin cattle require a ration higher in protein, minerals, and vitamins than do cattle that come into a feedlot carrying considerable fleshing. Also more skill and care is required in bringing thin cattle up to a full feed of grain than is required in feeding cattle that have been on good summer pasture.

Thin cattle should not be bought unless the feeder has had some experience in feeding cattle and has available a supply of high quality hay. However, if good pasture or cover crop is available in the fall for the cattle before they are put into the feedlot, thin cattle often will prove the more profitable. Thin calves should seldom be bought for feedlot finishing unless they can be obtained at a very low price as they often are unthrifty. In purchasing cattle of the lower grades it is especially important that they be selected carefully and only thrifty animals bought. Death losses usually are much higher among cattle that come into a feedlot in a thin or unthrifty condition.

Another point to consider in selecting a group of feeder cattle is uniformity and temperament. A uniform group will feed with less trouble to the feeder, will all be ready for market at about the same time, and will appear more attractive to the buyer when finished. The question of temperament of feeder cattle should not be ignored. Nervous, restless cattle will not make gains comparable to the calm, quiet animals that eat their fill and then lie down.

While feeder grade, breeding, type, and uniformity all are important, the most important factor is that they be bought right, that is, in accordance with their probable selling price. Losses do not occur, necessarily, in feeding a poor grade of cattle, but in purchasing them at the price of good cattle. An error at the time of purchase is often impossible to overcome by good feeding.

Age of Feeder Cattle

Regardless of sex or quality the feed required to produce a pound of gain, and therefor the cost, increases as the age of the animal increases. A summary of feeding tests conducted at the Lethbridge Experimental Farm reveals that to put a 100-pound gain on calves required approximately 35 per cent less hay and 20 per cent less grain than to put a 100-pound gain on yearlings when fed alfalfa hay and a full feed of grain. Yearlings, in turn, required approximately 10 per cent less hay and 5 per cent less grain to produce a 100-pound gain than did two-year-olds. However, one should not conclude from this that it always is more profitable to feed calves than older cattle, as other factors must be considered before such a conclusion is reached. Some of the more important factors to consider are:—

(1) The previous experience of the feeder. More care and experience, and a greater knowledge of proper feeding methods and nutritional requirements are necessary when feeding calves than when feeding older cattle of similar quality.

Figure 4.—A uniform group of feeder calves. Thrifty calves of good breeding make economical feeders. (Photo, courtesy of Alberta Department of Agriculture.)

(2) Nature of the feed available. On farms where most of the available feed consists of poor quality hay or other roughages with only a limited amount of grain, the feeding of two-year-olds and cows will be advantageous. If the amount of hay is limited but of good quality, and grain is in good supply calves and yearlings will make more economical use of the feed. Calves are not well suited to utilize roughages of low quality.

(3) Length of feeding period. Older steers and cows, if carrying good grass fleshing, will finish in from 60 to 90 days while those that are thinner will require up to 120 days. Yearlings require from 120 to 160 days feeding period and calves from 170 to 250 days (see Table I page 12). Thus cows, two-year-olds, and yearlings can be finished during the winter months when labor often is cheaper and more readily available, while calves must be carried well into the summer before they are ready for market. Cattle feeding carried on during the

spring and summer must compete for labor with that needed for spring cultivation. However, calves and yearlings have an advantage in that, if market conditions are unfavorable when the cattle are ready for market, they can be carried for an additional four or five weeks and still continue to make economical gains whereas when two-year-olds or older cattle are fat any further gains are very costly.

(4) Available feeder cattle. The number of each age of feeder cattle available in the fall and consequently the price that has to be paid for them will be dependent largely upon weather conditions that prevailed during the previous summer. After a dry year a large percentage of range and farm cattle will be feeder cattle as few will carry sufficient grass fleshing for immediate slaughter. Also after a dry year the ranchers are forced to sell a larger percentage of their calves and yearlings rather than carry them over on a short feed supply. If good range conditions prevail throughout the summer with an abundance of grass and an ample water supply many of the ranchers will keep their calves and a larger percentage of their yearlings, selling only two-year-olds and wet or dry cows culled from their herds. Therefore, in certain years the feeder will have to feed whatever is available while in other years he may exercise considerable choice.

(5) Margin. As pointed out under the section dealing with margin, older cattle often can be fattened more profitably on a smaller margin than calves because of the higher initial weight. In feeding calves the feed represents a higher percentage of total costs than when older cattle are fed. In the case of the latter the initial cost of the cattle represents the main factor of cost.

Table I.—Guide to Expected Gains and Feed Requirements of Sheep and Cattle

Class of feeder animal	Purchase weight	Market weight[1]	Gain	Average daily gain[2]	Average number days on feed	Feed requirements per 100 pounds gain		Total feed to finish 100 head	
						Barley	Hay	Barley	Hay
	lb.	lb.	lb.	lb.	days	lb.	lb.	bu.	ton
Lambs (light).....	55	95	40	0·30	135	440	590	370	12
Lambs (medium).....	65	100	35	0·32	110	460	600	350	11
Lambs (heavy).....	75	105	30	0·33	90	475	600	300	9
Feeder ewes.....	100	125	25	0·35	70	480	820	250	10
Steer calves.....	430	810	380	1·9	200	475	490	3,800	93
Heifer calves.....	400	750	350	1·8	195	480	505	3,500	88
Yearling steers.....	710	1,010	300	2·0	150	550	630	3,440	95
Yearling heifers.....	680	930	250	1·9	130	560	645	2,920	81
2-year-old steers.....	890	1,150	260	2·1	125	580	655	3,140	85
2-year-old heifers.....	850	1,060	210	2·0	105	585	675	2,560	71
Cows.....	930	1,100	170	2·0	85	670	880	2,370	75

[1] Customary 3 per cent market shrinkage not deducted
[2] Gains are for cattle and sheep when full grain fed.

Sex of Feeder Cattle

Steers, as a general rule, make slightly greater and more efficient gains than do heifers and sell at a higher price per 100 pounds when finished. On the other hand heifers make less skeletal growth and, therefore, fatten faster with the result that less time is required to finish them. Heifers usually finish 5 to 25 days sooner than steers of comparable age and quality. Heifers never

should be carried to excessive fatness because of the usual price discrimination against over-fat heifers. For the most part heifer feeding should be confined to yearlings and calves.

Another disadvantage of purchasing yearling and older heifers is that some of them are likely to be in calf. This does not apply to heifer calves. Pregnant heifers do not command top heifer prices when finished. On the other hand non-pregnant heifers come in season regularly during the feeding period and cause considerable disturbance in the feedlot. Spayed heifers do not have this disadvantage nor is there the danger of any of them being in calf. However, very few spayed heifers are sold as feeders as the majority carry sufficient grass finish for immediate slaughter. Unspayed heifers make suitable feeders and can return a fair profit provided then can be bought at lower prices than steers.

Dry and wet cows culled from the breeding herd because of age, poor conformation, or barrenness, make suitable feeders, especially where wet beet pulp or other succulent feeds are available for feeding. Because of the relatively low market value of fat cows only cheap feeds can be used successfully in fattening them.

Degree of Finish

Unless the feeder has a specialized market for highly finished cattle it seldom pays to carry them to an excessive degree of fatness. If a feeder does have such a market only top quality feeder stock should be purchased. Low quality, off-type feeders seldom can be fattened successfully to a high finish. Gains made after an animal is well fattened are much more expensive than gains made earlier. The primary object in fattening stock for slaughter is the improvement of the quality of the lean meat through the deposition of fat between the bundles of muscle fiber. Any excess fat beyond the amount that is required to make the meat attractive, juicy, and well flavored is largely waste as few people eat much fat.

While it may add prestige to the feeder to "top the market" the wise feeder will sell his stock just as soon as they are sufficiently well fleshed to return the most profit. If a feeder has a large amount of feed on hand it usually will be more profitable to feed a larger number of cattle to a medium-to-good finish rather than feed a smaller number to a very high finish.

It was pointed out under the discussion on margin that it usually costs more to put on a pound of gain than what it will sell for. Therefore, the primary object in fattening is to increase the value of the initial weight of the animal. Since a sufficient premium seldom is paid to compensate for a high finish, the feeder is well advised to sell just as soon as the cattle have reached a good market finish.

However, while it does not usually pay to over-finish cattle neither is it profitable to sell under-finished cattle. Cattle that lack sufficient finish for market requirements are a "drag" on the market and do not command a price in line with cattle that are well finished.

Length of Feeding Period and Gains to be Expected

The length of time required to fatten feeder cattle will depend on many factors. The most important of these are age and initial condition of the animals when put on feed. The method of feeding, that is, full grain feeding or limited grain feeding, also will influence greatly the length of time required to finish cattle. The quality of the feed, the combination of feeds, the weather

conditions prevailing during the feeding period, and the skill of the feeder are still other factors that have an important bearing upon the length of time required to finish feeder cattle.

In many feeding experiments conducted at Lethbridge two-year-old steers fed only a limited amount of grain finished in 120 to 140 days, whereas two-year-olds fed heavily on grain finished in 90 to 120 days. Yearling steers full fed grain finished in 120 to 160 days and calves from 180 to 220 days. None of these cattle were carried to excessive fatness, and all were what would be called medium-to-well-bred feeders. Mature cows can be expected to finish in 60 to 90 days if full grain fed. Heifers usually will finish 5 to 25 days earlier than steers of comparable ages (*see* Table I).

The gains to be expected in fattening feeder cattle will be dependent largely upon the age of the animals, the quality and quantity of the feeds fed, and the care that the animals receive. Under good feeding conditions, where good quality feeds are fed and a dry comfortable feedlot is provided, two-year-old steers will gain between 2 and 2·5 pounds daily, yearling steers between 1·75 and 2·5 pounds daily, and calves between 1·75 and 2 pounds daily (*see* Table I). Heifers normally make slightly smaller gains than steers, but because they make less skeletal growth they usually finish in less time than do steers. If the cattle are self fed grain larger gains will be obtained.

FACTORS TO CONSIDER WHEN PURCHASING AND FEEDING LAMBS AND EWES

Type of Feeder Lambs

Only strong, vigorous lambs should be purchased for feeding. Lambs that have had poor summer range often take considerable time in the feedlot before they start to gain. Unthrifty lambs also may be heavily infested with parasites, either internal, external, or both, and cannot be expected to make satisfactory gains. However, this does not mean that small lambs should not be bought as feeders as often their smallness is due to the fact that they were twin lambs or were lambed late. Small lambs make satisfactory feeders and often return a larger profit than heavier lambs provided they can be bought more cheaply.

The smaller and lighter lambs will require a longer feeding period to fit them for market. A larger total amount of feed will be required to finish the smaller lambs but the feed per pound of gain is usually less than that of heavier lambs. Whether the feeder would be advised to feed small or large lambs would depend on how long he wishes to feed and also on any differential in price of small and large feeder lambs.

If small and large lambs are purchased together they should be sorted into uniform groups and fed separately. When small and large lambs are fed together the small ones are crowded back from the troughs and mangers and do not get a full ration. Consequently, they do not fatten until the large lambs are taken out. Also the larger lambs often get too much feed which may cause heavy death losses. When facilities are not available for dividing the lambs into separate groups or when less than 500 lambs are fed it is desirable to buy a group uniform in size and condition in order that they may finish more evenly and be sold in as few drafts as possible. Lambs do not finish at the same rate and even in groups that were uniform at the beginning of the feeding season some will be ready for market considerably earlier than others. It is poor economy to overfinish lambs or hold them after they are

prime for market even though their weight may not have reached the maximum the market will accept. The reason is that the costs of putting on a pound of gain increase materially as they get fatter.

Age and Sex of Feeder Lambs

While age and sex are very important considerations in the feeding of cattle they are relatively unimportant from the standpoint of the sheep feeder. With the exception of a few aged ewes practically all sheep that reach feedlots are lambs. There is relatively little difference between wether and ewe lambs in gains, feed requirements, or market value.

Aged ewes, culled from the breeding flock because of age, poor teeth, or defective udders often are available in the fall as feeders. While little experimental evidence is available regarding the economy of feeding such sheep as compared with feeding lambs, experience has shown that aged and cull ewes make satisfactory feeders provided suitable feeds are available. Cull ewes, if thrifty, will make larger daily gains than lambs but will require more feed per pound of gain. They usually are finished for market within 50 to 70 days after being put on feed. Because many aged ewes have poor teeth such feeds as wet beet pulp and other succulent feeds are very satisfactory for them. Also because of the cheapness of such feeds they are ideal for ewes. It is sometimes advisable to coarsely grind grain for old ewes if they have bad teeth. Death losses are apt to be much higher than when lambs are fed, often reaching as high as 10 per cent. Because of their low selling value, higher death losses, and higher feed requirements old ewes must be bought at a comparatively low price per pound to make them economical feeders. In practice old ewes generally are purchased by the head.

Degree of Finish

Lambs never should be carried to excessive fatness as gains made after a lamb is well finished are very expensive. However, it is equally important that underfinished lambs should not be offered for sale. Each year many lambs reach the market in an unfinished condition possibly because the feeder is unable to judge finish or because of insufficent feed. The feeder should gain as much experience as possible in being able to pick out lambs that are sufficiently well finished and selling them when finished. Until such time as he has gained this experience he should seek the assistance of an experienced sheepman who can help him cut out and market lambs that are sufficiently well finished.

Length of Feeding Period and Gains to be Expected

The length of feeding period and gains to be expected will depend largely upon the initial weight of the lambs when coming into the feedlot, the quality of the lambs, the method of feeding employed, and the feeds fed. The management and care which they receive while in the feedlot will also affect the length of time that they must be fed before they reach good market finish.

Thrifty lambs, on full feed, can be expected to gain over 2 pounds a week. Thus a 65 pound lamb should reach good market weight and finish (95 to 100 pounds) in about 100 to 110 days, while a 70 pound lamb should be ready for market in approximately 90 to 100 days. Cull ewes should finish in 50 to 70 days. The average length of feeding period and the gains to be expected with various sizes of feeder lambs and old ewes when full fed grain is shown in Table I (page 12).

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THE FEEDLOT AND FEEDLOT EQUIPMENT

The Feedlot

In planning a feedlot the feeder, while having an eye to economy, should keep in mind certain essentials. The three primary features of any feedlot are that it affords maximum comfort to the animal, conserves the maximum amount of manure of high fertilizing value, and is so arranged that minimum amount of labor is expended in feeding and caring for the fattening stock. Experienced feeders know that dry, well-bedded feedlots, which afford adequate protection against driving winds and storms, are important to the production of rapid and economical gains. In southern Alberta, where the winters usually are moderate, elaborate and costly feedlots are not required. A tightly constructed single-ply board fence made out of rough lumber 5 to 7 feet high for lambs and 7 to 8 feet high for cattle usually supplies adequate shelter. This also provides a fence high enough to exclude dogs from the lamb feedlots if the gates also are made high and tight. Many feeders feel that a covering over part of the feedlot to protect their stock during stormy weather will improve gains and lower feed requirements. Fattening animals that are kept dry and well protected often will pay for the cost of the shelter in the feed that is saved in one year.

The site chosen for the feedlot should be adjacent to a supply of clean water and reasonably close to the farmstead to facilitate feeding operations in relation to other work to be done on the farm. The site should be a well-drained piece of land preferably on a southerly slope so as to get the maximum amount of sunshine. Avoid a site that has too much slope so that all the valuable fertilizing elements of the manure drain away.

The size of the feedlot will depend on the number of stock which the feeder plans to feed. It should be as small and compact as possible so as to make the greatest use of the bedding, to conserve the maximum amount of manure, and to avoid too much movement of the stock. As a general rule, depending somewhat on age and size of the stock fed, cattle should be allowed approximately 100 square feet of space per head and lambs and ewes 10 square feet per head exclusive of manger and trough space. If large numbers of stock are being fed it is advisable to divide them into uniform groups of approximately 75 to 100 head of cattle, and 400 to 500 lambs.

Water is of prime importance for successful feeding and for this reason special consideration should be given to the provision of an adequate supply of clean drinking water and suitable watering facilities. Stock should not be forced to drink water out of dugouts or reservoirs, as these soon become contaminated with manure and filth, but should be provided with clean water in troughs that are kept clean and free of ice. If good well water is not available, water pumped or run by gravity from a dugout or reservoir into troughs should prove satisfactory, especially if precautions have been taken to ensure a good supply of fresh water in the reservoir in the fall before feeding starts. The water troughs should be in the feedlot so that the stock can drink at any time of the day. They should be located on an area of the feedlot that will remain dry. If this is not possible a concrete platform should be built around the troughs so that the stock are not up to their knees in mud and manure when drinking.

Depending on the weather and type of feed, cattle will drink between 4 and 10 gallons of water per head daily, while lambs will drink approximately one gallon per head daily. If large quantities of wet beet pulp or silage are being fed, cattle and lambs will not drink as much water as when on dry feed, but it should not be assumed that they require no water. A tank heater to keep water troughs free from ice during cold weather is a necessary part of feedlot equipment. However, there is no need of warming the water for fattening livestock.

Figure 5.—A feedlot that does not supply adequate protection against winds and storms.

Figure 6.—Note the contrast between this sheltered and well-bedded feedlot and that shown in Fig. 5. Maximum gains cannot be expected unless the cattle are well fed and comfortable.

An adequate supply of bedding should be on hand or available before the feeding season starts. Frequent applications of bedding are required throughout the feeding period especially during wet weather or when snow melts. If the feedlot is to be kept dry and if the maximum amount of manure is to be produced and properly conserved 100 head of cattle or 1,000 head of lambs will require at least two tons of bedding every week. Dirty feedlots are often the cause of slow, expensive gains as well as lowering the animals' resistance to diseases. Livestock buyers will not offer top market prices for cattle or sheep coated with manure and muck. In those areas of southern Alberta where chinook winds are prevalent it often is practically impossible to keep the ordinary feedlots dry.

Figure 7.—Economical gains are never obtained in dirty feedlots. Livestock buyers cannot afford to pay top market prices for cattle coated with manure. Note the contrast between the above feedlot and the well-bedded feedlot shown in Figure 6.

Where difficulty is encountered in preventing the feedlot from becoming a quagmire, paving the entire feedlot or at least those parts around water troughs, feed mangers, and feed bunk will be a decided advantage and well worth the initial cost. It will make the stock more comfortable thus increasing gains and will conserve a greater tonnage of manure of higher fertilizing value.

Every feedlot should have a hospital pen that is well sheltered and kept well bedded for all animals that show signs of going off feed or any sickness. A sick animal should never be left with the rest of the stock as it will be pushed about and trampled on and will have little chance of getting to the feed trough or manger. It also may be the agent for spreading diseases to healthy stock in the same feedlot.

Figure 8.—A well-planned lamb feedlot in the Lethbridge district. Note the plentiful supply of bedding and the shelter and protection provided against storms and winds.

Figure 9.—A well-planned lamb feedlot, illustrating the use of a self feeder built into a granary.

Feedlot Equipment for Cattle

The prospective feeder, who is planning to build a new feedlot, would do well to visit a number of feedlots in his own or neighboring districts and check their design and the equipment used. Practically every feedlot has some worthwhile and practical features and by combining a number of such features an efficient, economical, and labor saving feedlot can be constructed.

The type of equipment that will be satisfactory for a given feedlot will depend largely upon the feeds being fed and the method of feeding employed. Some feeders prefer to hand feed both the grain and roughages while others give preference to self feeders as much as possible. Again some prefer to cut or grind the hay while others feed it in the long form. Each system of feeding requires different equipment. If hand feeding methods are employed each animal should be provided with 2 linear feet of manger and trough space. When cattle are self fed less feeding space is required; 1 linear foot of manger and trough space per head is usually sufficient. However, until such time as they are on self feeders they require the same amount of trough and manger space as do hand fed cattle.

Figure 10.—A convenient method of feeding hay or dried beet tops to cattle. Hay may be either stacked in the feedlot at haying time or hauled to the feedlot as needed.

Hay and dried beet tops usually are stacked along the inside of the enclosure and fed through a pole fence (*see* Figure 10). The hay may be pushed up once or twice daily or may be so stacked that the cattle are able to feed at all times. Pulp, silage, and grain usually are fed in feed bunks either placed in the feedlot, if all cattle are fed in one group (*see* Figure 14), or along either side of then passageway between the different lots if the stock are divided into a number of groups (*see* Figure 11). The feed bunks, especially for wet pulp and silage, should not be too deep, (approximately 10 to 12 inches) and should be placed so that they get the maximum amount of sunshine. The practice of feeding wet pulp on the ground is not to be recommended as it is wasteful of feed especially during wet or cold weather.

Figure 11.—Feeding wet beet pulp. This is a common method of feeding wet beet pulp either mixed with grain and molasses or alone. Chopped hay or silage may be fed in the same manner. Proper arrangement of the feedlot can mean much saving in time and labor.

Figure 12.—A suitable type of manger for feeding silage or wet beet pulp to cattle.

All mangers, feed bunks, and fences used in cattle feedlots should be constructed strongly to withstand the rubbing and pushing of the cattle. Feed bunks and mangers should be made of two-inch planking and all posts should be firmly set in the ground. Gates should be strong and well supported. Wire fences in feedlots should be avoided as much as possible.

Other equipment considered essential by many experienced feeders is a cutting and sorting chute, a branding and dehorning squeeze, and a set of stock and feed scales. A strongly constructed cutting and sorting chute and a good saddle horse will facilitate cutting out cattle ready for market or separating cattle that must be dehorned, branded, or vaccinated. A dehorning and branding squeeze is required not only for branding and dehorning when the cattle are brought into the feedlot, but it is useful if they must be vaccinated against diseases, or if an animal must be dosed with a medicinal treatment. A set of stock scales with a removable rack, so both feed and cattle can be weighed on it, will be valuable in keeping accurate records of gains made and feed eaten throughout the feeding period. Also, if cattle or feed are bought from a neighboring farm or ranch, a set of scales often will save many miles of trucking to the nearest town to obtain weights. While these items may seem a large outlay they will be well worth their cost especially if large numbers of stock are fed.

Feedlot Equipment for Sheep

The type of troughs and feed racks used will vary according to the methods of handling and feeding followed. Some feeders follow the practice of having the feed troughs and racks in the corral with the lambs, while others prefer to have only the hay racks and the troughs for pulp and silage, if fed, in the corrals and have the grain troughs in a separate feed yard into which the lambs are turned twice daily for grain feeding. When a large number of lambs is fed it is preferable to keep them in 2 or more groups and by using a separate grain feeding yard a smaller number of grain troughs is required as the same troughs can be used for all groups. An added advantage of having a separate grain feeding yard is that the grain can be distributed evenly along the troughs before the lambs are turned in, thus preventing some lambs from getting too much grain. This arrangement also permits hay, silage or pulp to be hauled into the main corral while the lambs are in the grain feeding yard, thus avoiding danger of running over lambs with trucks or wagons. If the self feeding method of feeding grain is used there will be no need of a separate feeding yard.

Whatever method of feeding is used sufficient feeding space should be provided for all lambs being fed to eat at one time. Each lamb should be provided with approximately 12 inches of feeding space at both the grain trough and the hay manger.

Hay and beet tops usually are fed through panels (see plans for this panel in Fig. 22) which may be placed along one side of the corral either in a straight line or set at right angles or zigzag to provide more feeding space. A plan of a lamb feedlot is shown in Fig. 21. This plan illustrates an arrangement of feeding panels that provides a maximum amount of feeding space. Pulp and silage also may be fed through such panels but often it is wasteful of feed to do so. Feed racks, as shown in Fig. 18, are satisfactory for hay, silage, pulp, and grain feeding. Grain feeding troughs should have a flat bottom about 10 to 12 inches wide, to prevent the lambs from eating the grain too quickly. Troughs such as are illustrated in Fig. 22 have proved very satisfactory in many feedlots.

A chute for cutting and sorting lambs should be a part of the equipment in every lamb feedlot. It will eliminate much unnecessary labor in sorting out lambs ready for market. Such a chute can be constructed easily and cheaply along one wall of the shelter (see Figs. 21 and 22). A well-trained lead sheep will also save much labor in handling sheep.

Figure 13.—A suitable type of grain feeding trough for cattle, if protected from the wind.

Figure 14.—A popular type of pulp and grain feeding trough for cattle where it is desired to have the troughs in the feedlot. The type of trough shown in Figure 11 is very popular with many feeders.

Figure 15.—A set of scales suitable for weighing livestock and feed will pay for itself many times over.

Figure 16.—A branding and sorting chute and a squeeze are essential parts of any cattle feedlot.

Figure 17.—Many lamb feeders prefer to have a separate grain feeding yard into which the lambs are turned twice daily for grain feeding. Three or four groups of lambs can be fed in the same grain troughs. This system makes more efficient use of grain troughs and is a most satisfactory way of feeding grain, so that all lambs can get their grain allowance and none gets more than its share.

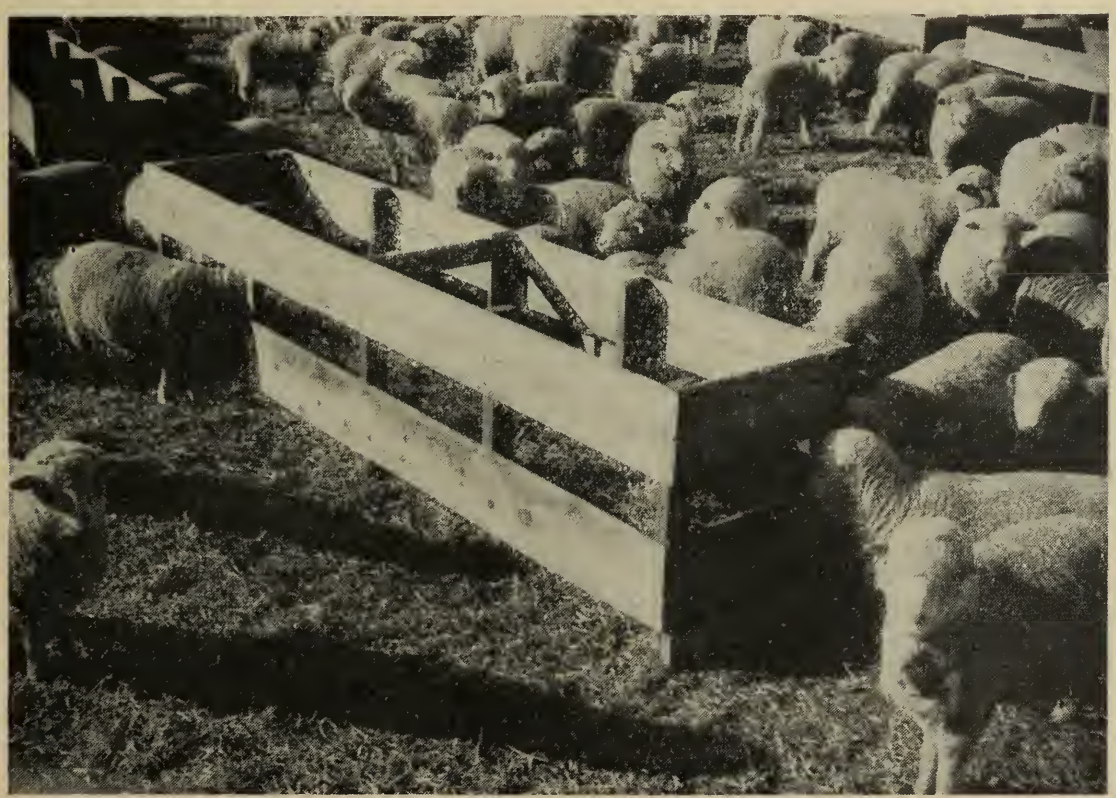


Figure 18.—This type of feed trough can be used for feeding pulp, hay, grain, and beet tops. It is easily handled and cleaned.

Figure 19.—Feeding hay through panels has proved a very satisfactory method. The hay is pushed up to the panels once daily. Beet tops also may be fed through panels.

Figure 20.—Feeding wet beet pulp on the ground through panels often is very wasteful of feed.

VALUE OF FEEDLOT MANURE

The value of the manure from the feedlot is no small part of the total value derived from feedlot finishing. Many farmers in the irrigated area, especially where sugar beets, potatoes, or canning crops are grown, claim that the value of the manure is sufficient to cover practically all labor and overhead costs involved in feedlot finishing. Many years of experimental work carried out at Lethbridge to determine the value of farm manure in various sugar beet, cereal grain, and forage crop rotations on irrigated land has shown that, on the basis of 1954 values of these crops, manure had a value of between $5.00 and $8.00 per ton, based on increased yields obtained. Table II shows the increased yields obtained from the application of farm manure in one of the rotations that was studied.

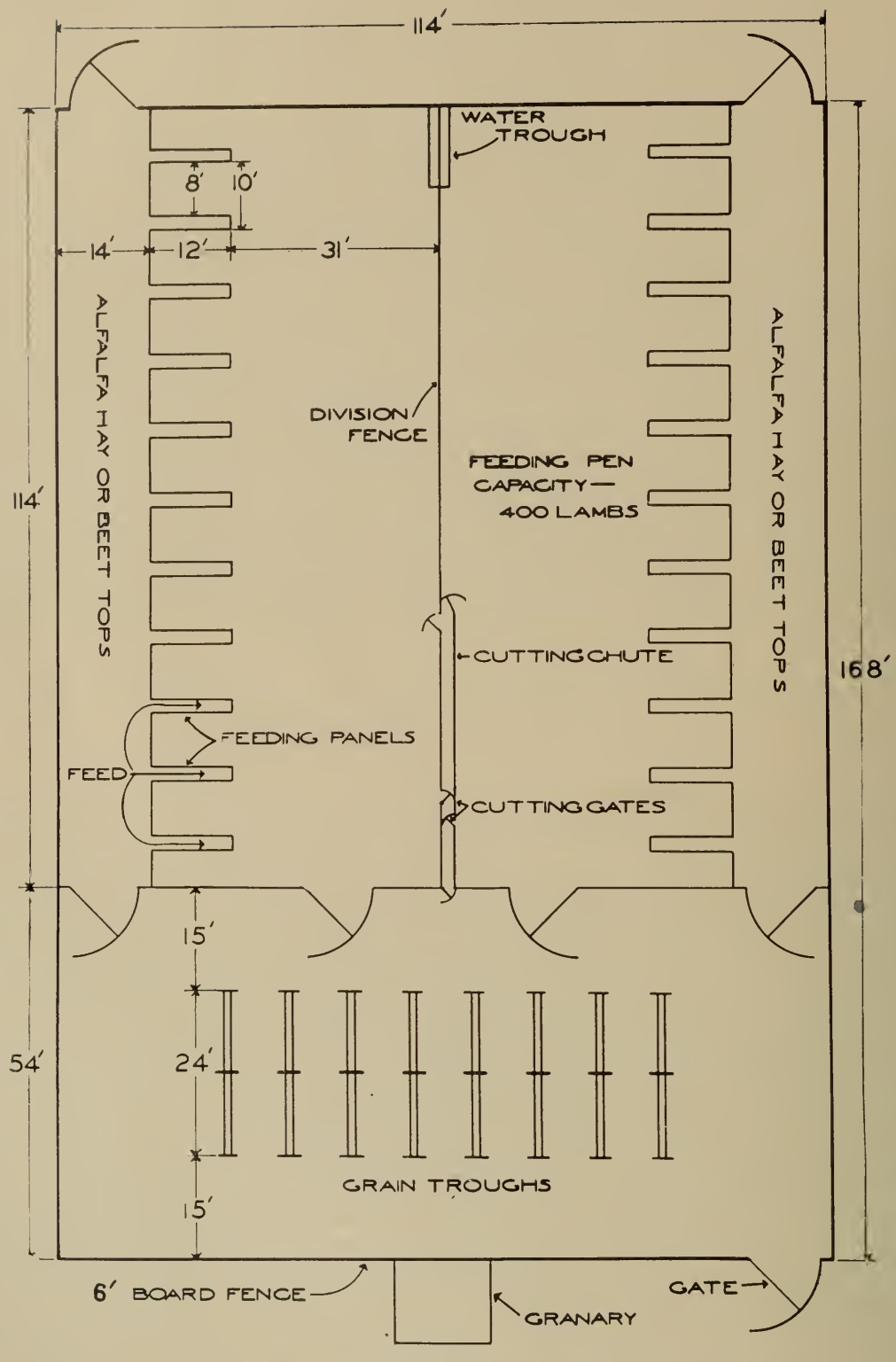
Table II.—The Influence of the Application of 30 Tons of Manure per Acre on an 8-Year Rotation of Sugar Beets, Wheat, and Alfalfa on Irrigated Land (9-Year Average)

Crop		Yield per acre[1] with manure	Yield per acre without manure	Difference in yield due to manure
Wheat	bu.	39·5	32·4	7·1
Sugar Beets[2]	tons	18·5	12·6	5·9
Sugar Beets[2]	tons	18·3	15·0	3·3
Wheat	bu.	54·5	49·2	5·3
Wheat (seeded with alfalfa)	bu.	50·9	45·3	5·6
Alfalfa	tons	2·7	1·8	0·9
Alfalfa	tons	2·8	1·5	1·3
Alfalfa	tons	2·4	1·3	1·1

[1] 30 tons of manure per acre was plowed under with the stubble during the fall of the year previous to the start of the rotation. Thereafter no manure was added.

[2] 100 pounds of triple superphosphate fertilizer per acre was applied to the land each year that sugar beets were grown.

Figure 21.—Manure is a very valuable by-product of the feedlot finishing industry. A good supply of feedlot manure properly preserved and applied to the land each year speaks for permanency in agriculture. Not only does manure add nitrogen, phosphorus, potassium, and other elements to the soil but it also adds organic matter, bacteria, vitamins, and hormones so vital to abundant plant growth.



NARROW PANEL LAMB FEED LOT

FOR 800 LAMBS

Figure 22.—A plan for narrow panel feedlot with sufficient space for 800 lambs. The arrangement of feeding panels as shown in this plan is very satisfactory where lambs are hand-fed.

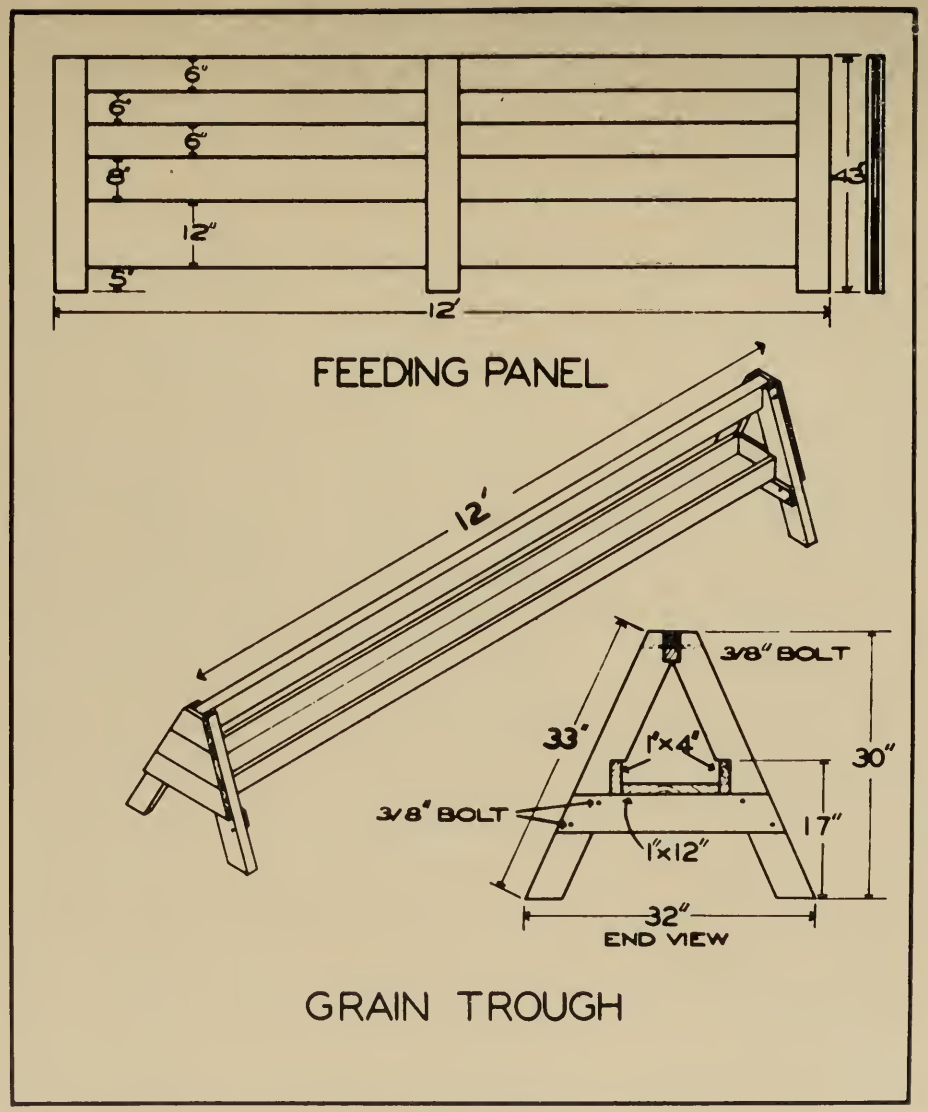


Figure 23.—Left, a plan of a hay panel and grain trough for lamb feeding. A series of hay panels, arranged as shown in Figure 21 or similar arrangement is very satisfactory for feeding hay and beet tops to lambs. Grain troughs such as illustrated are easy to clean and will give many years' service. They should be turned over on their side when not in use. Right, a well-planned cutting chute and gate in each feedlot will facilitate sorting out lambs ready for market.

The value of the application of manure should not be judged solely on the actual monetary value returned in any one year. Its value in adding organic matter to the soil, which aids in retaining moisture and improving soil texture is a very important consideration. A good supply of manure applied to the land each year is one assurance of permanency in agriculture.

While no records have been kept at the Lethbridge Experimental Farm of the total amount of manure produced by fattening cattle and sheep it is estimated that cattle will produce 2 and sheep 1½ times as many tons of manure as tons of feed eaten. However, if these amounts of manure are to be produced and if the manure is to be of high fertilizing value, the feedlot must be compact and kept well bedded at all times so that a thick mass of manure will result. The feedlot should, as pointed out previously, be on level or very slightly sloping ground so that the valuable fertilizing elements of the manure will not be drained away. Manure that is allowed to dry out or heat will lose some of its high ferilizing value.

On the basis of the above estimates and on the basis of total feed requirements shown in Table I, 1,000 lambs fed for 90 to 100 days will produce approximately 250 tons of manure and 100 yearling steers fed for 140 to 150 days will produce approximately 350 tons of manure. Therefore, the manure from the average feedlot of 1,000 lambs, if the feedlot is kept will bedded, should be worth at least $2,000 at 1954 prices of farm crops and from the average feedlot of 100 head of yearling steers it should be worth at least $2,750.

PREPARATION OF FEEDS

Grinding Grain for Cattle and Sheep

In general all cereal grains should be ground for cattle. Tests have shown that grinding cereal grains will increase their feeding value 20 to 40 per cent for fattening cattle. However, grain should seldom be ground into a fine meal. Coarsely ground or rolled grain is more palatable than finely ground grain and is less likely to cause cattle to go "off feed". Sometimes whole oats or barley is fed during the first few days that cattle are in the feedlot or until they become accustomed to eating grain. Often calves are fed whole oats until they are up to a full feed and then gradually are changed to coarsely ground or rolled grain.

Sheep on the other hand are best able to do their own grinding and should be fed whole grain, with the possible exception of old ewes with bad teeth. Tests conducted at the Lethbridge Experimental Farm showed that ground barley was unsatisfactory for fattening lambs, proving unpalatable and causing a catarrhal condition in the lambs. Feed costs per 100 pounds of gain were over 30 per cent greater for the group fed ground grain than for the group fed whole grain. Other experiments comparing whole and ground oats and whole and ground wheat have given similar results.

Cutting and Grinding Hay for Cattle and Sheep

Whether it will be advisable or economical to process hay by cutting or grinding it for fattening cattle or sheep will depend on many factors. The most important of these are the supply and price of the hay, the quality of the hay, and the ease of transporting and feeding cut hay as compared with long hay. The use that can be made by other stock of the refused long hay from the feedlot also must be considered. It should be remembered that processing hay does not make a concentrate feed out of a bulky hay crop. Processing changes only the form but not the composition of the feed. However, it does lead to a more complete consumption of the roughage.

The more complete consumption of processed hay may be a disadvantage or an advantage depending largely on the quality of the hay. If processed hay of poor quality is fed the stock will be forced to eat the coarse, woody stems of very low feed value along with the rest of the hay. If such hay is fed in the long form the stock will pick out the choicer parts and leave the coarse, less digestible parts. Stock will not make satisfactory gains if forced to eat coarse, poor quality hay. On the other hand processing good quality hay is often an advantage.

In one feeding trial at Lethbridge a comparison was made in which one group of calves was fed a mixture of 6 parts of alfalfa hay and 1 part of green oat bundles put through a silage cutter while another group was fed a similar mixture without being cut. The saving of hay was not sufficient to pay for the cost of cutting.

Other tests comparing cut alfalfa hay with long alfalfa for both cattle and lambs showed that processing of the hay prevented considerable waste and reduced the amount of hay required to put on a 100 pound gain.

In the final analysis the feeder must consider all the above mentioned facts before making a decision. If the hay is of medium to poor quality and any use can be made of the refused hay, such as feeding it to dry stock being wintered over, it usually will not pay to process it. On the other hand if hay is scarce and costly and facilities are available for feeding chopped hay the cost of processing usually will be offset by the more complete consumption of the feed. Many experienced feeders prefer to process their hay and grain together and feed the mixture in a self feeder. In this way less labor is involved and the proportion of grain to hay fed can be controlled.

Where sugar beet or cannery by-products are feed, alfalfa or other hay is fed in only limited amounts and when fed in this way the stock usually clean up long hay with very little waste. If hay is processed, fine grinding or cutting should be avoided as this results in a very dusty and less palatable feed. Cutting or coarse grinding has given better results than fine grinding and costs much less.

FEEDING AND MANAGEMENT

Starting Cattle on Feed

Cattle that have to be shipped a considerable distance before arriving at the feedlot should be fed and handled with special care particularly if cold, damp weather prevails. Death losses from shipping fever and other diseases associated with the movement of cattle by train or truck usually are due to overdriving, overcrowding, and lack of rest, water, feed, and proper shelter during transit. If feeder cattle have to be shipped long distances a veterinarian should be consulted as to the advisability of vaccinating against shipping fever before the cattle are shipped. Feeder cattle shipped long distances should be fed and watered as often as possible during transit.

Upon arrival at the feedlot they should be provided with a dry, well-bedded shelter. Cattle should be fed and watered with special care for the first few days as most feeder cattle are not accustomed to grain and many are not accustomed to hay. They should be fed sparingly on hay and allowed no grain until they have become accustomed to their feed and surroundings. Any animals that show signs of sickness, such as coughing, shivering, loss of appetite, watery eyes, or discharges from the nose should be removed to a hospital pen and a veterinarian should be called. Such symptoms usually are associated with shipping fever.

All feeder calves that have not been vaccinated against blackleg should be vaccinated either before they are sent to the feedlot or soon after their arrival at the feedlot.

Once the cattle have become accustomed to their surroundings a small amount of grain may be fed, usually about one pound of whole oats daily per head. This amount is increased gradually as they become accustomed to the grain. Special care must be exercised to not increase the grain allowance too rapidly as it may put the cattle "off-feed". Overfeeding should be avoided at all times. All grain should be measured out carefully each day until such time as the cattle are up to a full feed of grain. Cattle that go "off-feed" may take several days or even weeks to come back to a full feed of grain thus causing lower gains and increased feed costs.

Best results from feeding are secured when the cattle are fed at regular hours and and when the feeder is quiet and kind to his animals. All changes in amount or kind of feed should be gradual. Any tendency on the part of the stock to not come to the trough immediately grain is fed should be watched carefully. The droppings or manure should be observed each day and if there is any indication of scouring the grain allowance should be lowered. If wet beet pulp or beet tops are being fed liberally it often is impossible to prevent a certain amount of scouring. Scouring, nevertheless, should be taken as a warning of something wrong, such as overeating, faulty ration, or unwholesome feeds being fed. An animal that scours severely may lose as much as a week's gain in one day. For the first few weeks no more grain should be fed than will be cleaned up readily within 15 to 20 minutes after feeding.

The practice followed at Lethbridge in getting cattle on feed is to feed no grain the first day or so that they are in the feedlot and only a limited amount of grass hay such as timothy brome, or prairie hay. Once the cattle have become accustomed to the feedlot they are given approximately one pound of whole oats per head and as much grass hay as they will eat. As soon as it is noticed that all cattle are eating grain the amount is gradually increased at the rate of 2 to 3 pound per head per week, the exact amount depending on how well they are taking to their grain. Coarsely ground chop, mostly oat chop, is substituted during the first week for the whole oats and then coarsely ground barley or wheat chop is slowly introduced into the ration. The increases in the amount of grain fed will be slower as full feed is approached. Calves usually take 6 to 8 weeks or even longer to reach a full feed of grain, yearlings and two-year-olds 4 to 6 weeks. Calves on a full feed of grain, provided wet pulp or molasses is not being fed and depending on the quality of the roughage fed, will eat up to 14 pounds of grain daily, yearlings up to 18 pounds, and two-year-olds up to 20 pounds. Alfalfa hay is introduced gradually into the ration during the first week.

If beet pulp is being fed there is less trouble encountered in getting cattle on feed. The most common practice followed, and one that has proved very satisfactory, is to feed mostly pulp and hay for the first few days and then gradually incorporate the grain into the pulp, increasing the ratio of grain to pulp as the feeding period advances. Some feeders, who do not feed pulp and who encounter some difficulty in getting their cattle up to a full feed, mix cut or ground hay with the grain for the first few days or throughout the entire feeding period.

The feeder should read carefully the sections of this bulletin dealing with each of the feeds commonly fed to fattening cattle and should have some appreciation of the advantages and limitations of each of the particular feeds that he is feeding.

Starting Lambs on Feed

What has been said regarding starting cattle on feed applies equally well to sheep. In fact, sheep are more sensitive to a change of feed, particularly to grain, than are cattle. Many experienced feeders maintain that more death losses in the lamb feedlot are caused by overfeeding than all other causes combined. What is commonly called overeating disease of lambs is very common when lambs are fed too much grain. This disease usually occurs 16 to 21 days after the lambs have been started on feed or if the amount of grain being fed is increased too rapidly. The usual symptoms or signs of this disease are that the lamb is seen staggering about the pen with head held high, or it may rush about the pen, blindly running into fences or travelling in circles. Others stagger, fall to the ground, and die suddenly. Most animals affected die within 2 or 3 days. If they do recover they never make good feeders. If such conditions occur the only known cure is to immediately reduce the amount of grain being fed and then once the trouble is over gradually bring the lambs back to full feed again. Patience and judgment are required in adapting animals to new feeds and in regulating the quantity fed.

Figure 24.—The characteristic pose of a lamb that is in the advanced stages of overeating disease. Note the position of the head. Overeating disease causes more death losses in lamb feedlots than all other diseases. It can be prevented by careful grain feeding.

A good practice is to feed no grain the first few days the lambs are in the feedlot, giving them time to become accustomed to their quarters. A small feeding of whole oats, usually about one-tenth pound per lamb daily, then is given. When all the lambs have learned to eat grain the amount is increased gradually so that by the end of the first month they are eating approximately one pound daily per lamb. Undue haste in getting them on full feed invariably will prove disastrous. No definite rules in feeding can be followed other than care and keen observation. Each group of lambs is an individual problem. Some lots are unable to consume more than a comparatively light feed without developing

digestive disturbances while others thrive on abnormally heavy feeding. Either scouring or overeating disease indicates that the animals are getting more feed than they can handle at that stage in the feeding period. If these danger signals are ignored the entire group may be thrown "off-feed" and considerable death loss may occur. When lambs are on full feed they will be eating approximately one and one-half pounds daily. While it is possible to go above this amount the inexperienced feeder is advised not to attempt it.

Self Feeding Grain to Cattle

The desire on the part of many feeders to reduce the time required to fatten cattle, and to reduce the labor requirements, has led many to self feed grains, especially where sugar beet by-products are not fed. Whether it will be advantageous to self feed will depend largely on the relative cost of grain and hay and the care taken to get the stock up to a full feed of grain.

Results of a number of tests conducted at Lethbridge to compare the merits of self feeding and hand feeding grain for finishing calves showed that self fed calves made faster gains and finished sooner than similar groups of calves hand fed grain. The self fed calves used 30 per cent more grain and 50 per cent less hay than hand fed calves in putting on 100 pounds of gain. Table III shows the relative cost of putting on 100 pounds of gain, as determined in these trials, using the self feed and hand feed methods of feeding at various prices of feeds.

Table III.—Feed Costs in Dollars of Producing 100 Pounds of Gain in Steer Calves by Hand Feeding and Self Feeding Grain with Hay and Grain at Various Levels. Based on Three Trials 1931-34

Grain at (per ton)	Method	Alfalfa Hay at (per ton)								
		$4	$6	$8	$10	$12	$14	$16	$18	$20
$10	Hand fed	3.04	3.42	3.82	4.20	4.60	4.98	5.38	5.76	6.16
	Self fed	3.04	3.26	3.49	3.72	3.94	4.16	4.39	4.62	4.84
$15	Hand fed	4.16	4.55	4.94	5.33	5.72	6.11	6.50	6.89	7.28
	Self fed	4.34	4.56	4.78	5.01	5.24	5.46	5.68	5.91	6.14
$20	Hand fed	5.29	5.68	6.07	6.46	6.85	7.24	7.63	8.02	8.41
	Self fed	5.63	5.86	6.08	6.30	6.53	6.76	6.98	7.20	7.43
$25	Hand fed	6.42	6.81	7.20	7.59	7.98	8.37	8.76	9.15	9.54
	Self fed	6.92	7.15	7.38	7.60	7.82	8.05	8.28	8.50	8.72
$30	Hand fed	7.54	7.94	8.32	8.72	9.10	9.50	9.88	10.28	10.66
	Self fed	8.22	8.44	8.67	8.90	9.12	9.34	9.57	9.80	10.02
$35	Hand fed	8.67	9.06	9.45	9.84	10.23	10.62	11.01	11.40	11.79
	Self fed	9.52	9.74	9.96	10.19	10.42	10.64	10.86	11.09	11.32
$40	Hand fed	9.80	10.19	10.58	10.97	11.36	11.75	12.14	12.53	12.92
	Self fed	10.81	11.04	11.26	11.48	11.71	11.94	12.16	12.38	12.61
$45	Hand fed	10.93	11.32	11.71	12.10	12.49	12.88	13.27	13.66	14.05
	Self fed	12.10	12.33	12.56	12.78	13.00	13.23	13.46	13.68	13.90
$50	Hand fed	12.06	12.44	12.84	13.22	13.62	14.00	14.40	14.78	15.18
	Self fed	13.40	13.62	13.85	14.08	14.30	14.52	14.75	14.98	15.20

It will be observed from this table that when grain is comparatively cheap in relation to hay it is profitable to self feed but should grain prices be high in relation to hay it will be more economical to limit the amount of grain fed. The relative amounts of hay and grain available may also be a deciding factor.

Older cattle make more economical use of larger quantities of roughage than do calves and yearlings and consequently self feeding of grain is not practised so generally with two-year-old and older cattle. However, when grain is comparatively low in price the labor saved and the earlier finish secured by self feeding may be sufficient to make the practice desirable for finishing steers of any age.

Self feeding of grain is not practised generally except for calves where wet beet pulp is available as pulp usually is a considerably cheaper feed than grain. Under such conditions the cattle usually are given a full feed of pulp and a limited amount of grain.

Hand feeding is necessary when cattle first go into the feedlot and care must be taken in getting the stock up to a full feed before they are put on self feeders. As soon as they are getting an amount that they do not readily clean up within about 30 minutes after being fed, the trough or self feeder should be filled and never permitted to become empty. Once cattle are on self feeders it is less likely that digestive disorders or trouble with their going "off feed" will be encountered.

Self Feeding Grain to Lambs

Self feeding grain to lambs is a common practice with some feeders but requires considerable judgment and experience if it is to be successful. Great care must be exercised in getting the lambs up to a full feed of grain before self feeding is attempted, and when self feeding has been started, the self feeders never must be allowed to become empty. Sufficient feeding space (10 to 12 inches per lamb) should be provided so that all lambs may feed. If insufficient space is available smaller lambs will be pushed back and when they do get to the trough they will gorge themselves. The danger of overeating disease is much greater with lambs on self feeders than with lambs properly hand fed.

Table IV.—Feeding Costs, in Cents, of Producing a Pound of Gain by Hand Feeding and Self Feeding Grain to Lambs with Hay and Grain Prices at Various Levels. Based on Three Trials, 1931-34[1]

Grain at (per ton)	Method of Feeding	Alfalfa Hay at (per ton)								
		$4	$6	$8	$10	$12	$14	$16	$18	$20
$10	Hand fed	3.6	4.1	4.7	5.2	5.8	6.4	7.0	7.6	8.2
	Self fed	3.8	4.3	4.7	5.1	5.6	6.1	6.5	7.0	7.4
$15	Hand fed	4.8	5.4	6.0	6.5	7.1	7.7	8.3	8.8	9.4
	Self fed	5.3	5.8	6.2	6.6	7.1	7.6	8.0	8.4	8.8
$20	Hand fed	6.0	6.6	7.2	7.7	8.3	8.9	9.5	10.0	10.6
	Self fed	6.7	7.2	7.6	8.0	8.5	9.0	9.4	9.8	10.3
$25	Hand fed	7.3	7.8	8.4	8.9	9.5	10.1	10.7	11.2	11.8
	Self fed	8.2	8.6	9.0	9.4	9.9	10.4	10.8	11.3	11.8
$30	Hand fed	8.5	9.0	9.6	10.1	10.7	11.3	11.9	12.5	13.0
	Self fed	9.6	10.1	10.5	10.9	11.4	11.9	12.3	12.8	13.2
$35	Hand fed	9.7	10.3	10.8	11.4	12.0	12.6	13.1	13.7	14.3
	Self fed	11.0	11.5	12.0	12.4	12.8	13.3	13.8	14.2	14.6
$40	Hand fed	10.9	11.5	12.1	12.6	13.2	13.8	14.4	14.9	15.5
	Self fed	12.5	13.0	13.4	13.8	14.3	14.8	15.2	15.6	16.1

[1] Death losses have not been considered in arriving at the above feed costs. The death losses were higher in the self fed groups than in the hand fed groups.

Results of three experiments conducted with fattening lambs at Lethbridge showed that self fed lambs made slightly greater daily gains than hand fed lambs but the death losses and feed costs were higher. Table IV shows the relative costs of putting one pound of gain on lambs by hand feeding and self feeding methods, with hay and grain prices at various levels, based on the results of these trials.

The inexperienced feeder is advised not to self feed grain to lambs until experience has been gained and even then it is a doubtful practice. Some feeders have had good success with self feeding a mixture of cut hay and grain, but considerable difficulty is often experienced in designing a suitable self feeder to handle such a mixture. A mixture of equal parts of dried beet pulp and grain has proved satisfactory for self feeding to lambs.

FEED REQUIREMENTS

The feed requirements per animal or per pound of gain will vary according to the age of stock fed, the class and type of stock fed, the climatic conditions prevailing during the feeding period, the ration fed, and the ability and judgment of the feeder. However, the feed requirements can be given in general terms and will give the feeder some idea as to the number of stock he can feed with the feed he has on hand. In Table I (page 12) the feed requirements are given in terms of alfalfa hay and barley, on the basis of 100 pounds gain, and in terms of total feed required to finish 100 head of lambs, ewes, calves, yearling cattle, two-year-old cattle, and cows. These requirements are based on average gains, for medium grade stock, when fed a well-balanced ration. If adverse climatic conditions prevail throughout the feeding period, or unthrifty feeder stock is purchased, or unbalanced rations are fed, or inadequate shelter is provided the feed requirements will be much greater than those given. On the other hand if the quality of feed fed is very good, favorable climatic conditions prevail, thrifty stock is fed, and the stockman is an observant feeder, the feed requirements will be less than those given.

If feeds other than barley and alfalfa are fed the replacement value of these feeds, in terms of barley and alfalfa must be taken into account. Their benefits and limitations are discussed later.

CHOICE OF FEEDS

The combination of feeds that gives the maximum gains throughout the feeding period at the minimum cost is one of the first considerations in the choice of feeds. While the aim in feedlot finishing is to utilize the feeds grown on the farm, often it may pay to purchase protein and mineral supplements if the feeds available on the farm do not properly balance the ration. Maximum and economical gains will not be obtained if unbalanced rations are fed. The feeder must have a full knowledge of the particular merits and deficiencies of each feed. Many feeds have a very high value when fed in rations that are complete in all the nutritive essentials but their value is exceedingly low when they are used improperly. For example, wet and dried beet pulp are very valuable feeds in the fattening ration if combined with other feeds that correct their deficiencies in proteins, minerals, and vitamins. However, they are of low value when fed with no regard for these deficiencies.

ESTIMATING THE AMOUNT OF FEED ON HAND

Often the feeder has little knowledge of the approximate amount of feed that he has on hand for feeding and is thus unable to calculate the number of cattle or lambs he can accommodate. Before undertaking to feedlot finish either cattle or lambs the feeder should make a careful estimate of the tonnage of hay or silage and the amount of grain that he has available for feeding, and then from this estimate calculate the number of cattle or lambs that this amount will finish. It is wiser to underestimate the feed supply than to overestimate it, as animals that must be sold in an unfinished condition because of insufficient feed seldom prove as profitable as those carried to the desired market finish.

Figure 25.—A good supply of feed is essential before undertaking to feed either cattle or sheep. If the hay is stacked on the feedlot at haying time, much labor is saved during the feeding period.

Rules are given below for estimating the number of tons of hay in a stack, the number of tons of silage in stack silage, and the number of bushels of grain in a granary.

Estimating the Weight of Hay in a Stack

The number of tons of hay in a stack of given size will vary according to the type of hay, that is, whether it is a grass, cereal, or legume hay, the length of time that the hay has been stacked, the amount of trampling when stacked, the dryness of the hay when stacked, and the weather conditions prevailing after the hay has been stacked. Hay that has been stacked when damp and has molded or burnt in the stack, or hay that has been rained on soon after stacking, will be much heavier per cubic foot of hay than hay that has been properly cured and stacked.

The following rule will give the approximate number of tons of alfalfa hay in a stack that has not molded or burnt and that has been stacked at least 60 days:—

Multiply the length of the stack (in feet), by the width of the stack (in feet) by one-third of the overthrow[1] (in feet) and divide by 500.

In measuring a stack of oat hay divide by 650, in measuring a stack of grass hay such as brome or timothy hay, divide by 600 and in measuring a stack of baled hay divide by 200, instead of 500. It must be remembered that the above rule gives only rough estimates, their accuracy depending largely upon the condition of the hay.

Estimating the Weight of Silage

As with hay the weight of silage in a stack or silo of any given size will vary according to the crop ensiled, the length of time the silage has been in the stack or silo, and the moisture content of the forage when ensiled.

The following rule will give the approximate number of tons of peavine silage in a stack that is at least 7 feet high after settling and that has settled 30 to 60 days:—

Multiply the length of the stack (in feet) by the width of the stack (in feet) by one-third of the overthrow (in feet) and divide by 45.

For beet top ensilage that is relatively free from dirt and that has been made from tops that have not wilted in the field for more than 24 hours, the tonnage can be estimated by using the above rule for peavine ensilage, but divide by 40 instead of 45. For silage in a silo multiply the width by the length by the depth and divide by 45.

From this estimate of tonnage must be deducted the amount that has spoiled around the edge and on top of the stack. This may vary from about 5 per cent to as high as 30 per cent.

Estimating the Bushels of Grain in a Granary

The approximate number of bushels of grain in a granary or bin can be estimated by the following rule:—

Multiply the length of the granary (in feet) by the width of the granary (in feet) by the depth of the grain in the granary (in feet) by 8 and divide by 10.

To estimate the weight of the grain in pounds, multiply the number of bushels in the granary, as obtained above by the number of pounds per bushel of grain being measure (wheat, 60; barley, 48; oats, 34; and rye, 56 pounds per bushel).

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[1] Overthrow is the distance from the base of the stack on one side, over the stack, to the base on the other side.

FEEDS FOR FATTENING CATTLE AND LAMBS

The Cereal Grains

In southern Alberta the cereal grains, barley, oats, wheat and rye, along with dried molasses, beet pulp and molasses, are the chief concentrate feeds fed to fattening cattle and lambs, with the exception that, in the immediate vicinity of the sugar beet factory, wet beet pulp constitutes a large part of the ration.

The cereal grains are excellent feeds for fattening stock but if good gains are to be obtained one must appreciate their merits and also must understand their limitations. The cereal grains are somewhat low in protein, very low in calcium, but are relatively high in phosphorus. Because of this they should be fed in conjunction with feeds relatively high in protein and calcium. If non-legume hays such as brome hay, timothy hay, or oat hay, or such feeds as beet pulp and molasses are being fed, protein and mineral supplements should be added to the ration. However, if a reasonable amount of good legume hay (alfalfa hay, sweet clover hay, peavine hay) or peavine silage is being fed along with cereal grains and other feeds no protein or mineral supplements will be necessary.

As pointed out previously, all the cereal grains should be coarsely ground for cattle, with the exception of the first few days that the cattle are on feed when whole grains are more desirable. The cereal grains should not be ground for fattening lambs.

Barley and Wheat

Barley is probably the most common cereal grain fed in the fattening ration, principally because many irrigation farmers grow it in preference to oats or wheat. However, many feeders feed large quantities of wheat, especially when the lower grades of wheat are available and when the price is not too far out of line with the other grains. Results of feeding trials conducted at the Lethbridge Experimental Farm to compare the relative feeding value of barley and wheat when fed with alfalfa hay to lambs indicated that barley, and a mixture of equal parts of barley and wheat were of practically equal value. A straight wheat and alfalfa ration showed slightly lower feed value than the other rations. For all practical purposes wheat and barley can be considered of equal feeding value, pound for pound, for sheep. A mixture of the two is preferred to either one alone. Less trouble from bloating and lambs going off feed has been encountered when barley is fed alone than when wheat is fed alone. Similar results were obtained when these grains were fed to fattening cattle. A choice between them would depend largely upon their relative price per pound.

Little difference has been found in the feed value of the various grades of wheat, in many cases the lower grades have given better results than the milling grades. However, the lower grades of barley cannot be considered equal in feeding value to the higher grades. In fact, very poor results often are obtained if light-weight barley is fed. There has been little, if any, difference found in the feeding value of spring and fall wheat or in the value of hard and soft wheats.

Oats

Oats fed to fattening cattle or lambs as the only grain, tend to produce more growth than finish, resulting in animals lacking in thick fleshing. Oats are more palatable than the other cereal grains and because of their bulky nature they are excellent to start lambs and cattle on feed. Many feeders feel that a limited

among of oats fed throughout the feeding period is desirable. If cattle or lambs go "off-feed" or if trouble is encountered with overeating disease of lambs oats are an excellent grain to feed until the trouble has been alleviated.

Oats never have been found to produce satisfactory finish when fed as the only grain to lambs and cattle at Lethbridge or at many other experimental stations. Low grade oats, that are mostly hulls, have no place in the fattening ration if maximum gains are to be obtained. However, if light-weight oats have to be fed, they will give better results with older cattle than with calves or lambs. On the other hand, hulless oats have been found to have a higher value than barley or wheat, pound for pound, as a fattening feed. It may be concluded that if good quality oats are available the feeder would be well advised to include some oats in his grain mixture, especially during the early part of the feeding period.

Rye

Rye is not commonly grown in the irrigated areas but there are certain years when a considerable amount of rye is available for feeding purposes. Many feeders are prejudiced against this grain as a feed as poor results have been obtained when it has been fed. Some of the poor results secured with rye have been due to the presence of ergot in the grain. The results of 2 experiments, at Lethbridge with lambs fed a ration of alfalfa hay and rye in comparison with a ration of alfalfa hay and barley and a ration of alfalfa hay and a mixture of barley and rye, showed that the lambs fed the alfalfa and rye made larger daily gains on less feed per pound of gain than the lambs fed alfalfa hay and barley. The lambs fed the mixture of barley and rye made gains practically identical with those fed the straight rye. Experiments conducted with fattening cattle in the United States have revealed that rye is equal in feeding value to corn. However, rye is less palatable than other grains and for this reason should not be fed alone if heavy consumption is desired. Rye is a less palatable feed for cattle than for sheep.

For all practical purposes rye, free from ergot, can be considered of equal feeding value to barley but because of its lack of palatability it should be fed in a mixture with more palatable feeds.

Legume Hays

The legume roughages (alfalfa, clovers, and peavines) are excellent for all farm livestock. They are palatable, rich in protein and calcium, and are one of the richest sources of vitamin A among the common feeds available.

Legume hays, because of these virtues, are excellent supplements to the cereal grains in the fattening ration and make good many of the deficiencies of the sugar beet by-products. Legumes, as a class, are somewhat low in phosphorus but as pointed out previously, the cereal grains are a fairly rich source of phosphorus. Thus a combination of one or more of the legumes and the cereal grains provides a ration adequate in practically all of the known essential nutrients required by cattle and sheep.

Alfalfa Hay

Of the various legumes, alfalfa is the most widely grown in the irrigated areas of southern Alberta. Not only does it produce a heavy yield of forage per acre but it is unexcelled as a roughage for fattening lambs and cattle. Because of its richness in protein, calcium, and vitamin A, a certain amount of good quality alfalfa hay should be included in every fattening ration. If at least one pound per head daily is fed to fattening lambs and 6 to 8 pounds per head daily to fattening cattle, along with a full feed of grain, there will be little if any need for adding protein or mineral supplements to the ration.

Early experiments conducted at Lethbridge showed that alfalfa hay fed alone was not a fattening feed; the animals tended to grow rather than fatten. If rapid gains and early finishing are desired grain or other high energy feeds must be fed liberally in conjunction with the alfalfa hay. These early experiments also indicated that up to one-half of the alfalfa hay, in an alfalfa hay and grain ration, could be replaced by such non-legume feeds as oat, or grass hay with no decrease in gains or increase in feed requirements. However, if sugar beet by-products are being fed in liberal amounts, alfalfa hay or other legume hays should make up all of the hay fed.

If best results are to be obtained alfalfa hay, like any other hay, must be of good quality. To be of good quality the hay must be cut before the plant becomes too mature and must be cured without exposure to rain. Hay that is left in the field any longer than is necessary to properly cure it, or is rained on, will lose most of its vitamin A content and most of the leaves will shatter off in subsequent handling, leaving only the coarse stems which are of low feed value. To combine maximum quality with maximum yield the crop should be cut when it is in 10 to 25 per cent bloom and handled to conserve the maximum amount of leaf. Good quality hay is green, leafy, and free from molds or other spoilage.

Figure 26.—Stacking alfalfa hay at the Lethbridge Experimental Farm. Good quality alfalfa hay is unexcelled as a feed for fattening lambs and cattle.

The belief is prevalent among some feeders that first-cutting alfalfa hay is superior to second-cutting hay as a feed for fattening stock. Experimental findings have shown that in some years one cutting is superior to another cutting largely because of difference in weather conditions prevailing when the hay was put up or because of difference in climatic conditions during the growing season. Usually first-cutting is somewhat coarser than second-cutting and less likely to cause bloat. Aside from this factor they can be considered of practically equal value in the fattening ration if of equal quality.

In many cases considerable trouble has been experienced from bloating when alfalfa hay is fed as the only roughage. This is especially so when stock first are put on feed. When beet pulp, molasses, peavine silage, oat hay, or other hays are being fed in combination with alfalfa hay and grain there is usually less trouble from bloat. If it is proposed to feed only alfalfa hay and grain as the fattening ration the feeder should mix some coarse hay or even straw with the alfalfa for the first few weeks of the fattening period.

Sweet Clover Hay

While sweet clover is not grown so extensively as alfalfa in the irrigated areas there are some farmers who prefer to grow it because it fits better into a short rotation.

Sweet clover hay is more difficult to cure than is alfalfa hay but if put up in good condition it makes an excellent feed for fattening stock. Like alfalfa it is rich in protein and calcium, and, therefore, helps correct the deficiencies of the cereal grains and sugar beet by-products. There usually is less trouble from bloat when sweet clover hay is fed than when alfalfa hay is fed. Nevertheless, it should be fed with care during the first few weeks the stock are on feed.

If high quality hay is to be obtained the hay should be cut just when the plants are beginning to bloom and it should be handled in the field so as to retain as much of the leaf as possible. Sweet clover hay that has molded should not be fed because of the danger of sweet clover poisoning. The feeder also should be cautioned against dehorning and performing any operations on stock being fed sweet clover hay. The blood of animals feeding on molded sweet clover loses the ability to clot. For this reason it never should be fed as the sole roughage but should be fed with at least an equal amount of some other roughage. Sheep do not seem to be affected by sweet clover poisoning to the same extent as cattle.

Grass and Cereal Hays

The grass and cereal hays (oat hay, brome grass hay, timothy hay, crested wheat grass hay, and prairie hay) are as a class much lower in protein, calcium and vitamin A than are the legume hays. For this reason it often is necessary to add protein and mineral supplements to the fattening ration when such hays are being fed as the sole roughage. However, if these hay crops are cut while the plants are still green and immature, and then properly cured, a good quality hay is obtained. Such hays are often satisfactory as the sole roughage for fattening mature stock. Nevertheless, best results are obtained with these hays when they are fed in conjunction with a legume hay.

Oat Hay (Greenfeed)

While oats or other cereal grains are not grown extensively for hay in the irrigated areas of Alberta, each year, largely because of weediness of the land or for other reasons, a considerable acreage of green oats is cut with the mower and put up as hay or cut with the binder and stacked as sheaves. If the crop is cut no later than when the oats are in the dough stage it makes a satisfactory feed for fattening lambs and cattle. However, if it is ripe before cutting it cannot be considered of any greater value than a mixture of straw and grain.

Results of experiments with fattening lambs and steers at Lethbridge showed that green oat hay or sheaves were equal to alfalfa hay when replacing not more than one half of the alfalfa hay in the ration. Green oat sheaves, when fed as the sole roughage with grain to fattening steers, were not so valuable as alfalfa hay.

Because oat hay or sheaves are low in protein and calcium, it normally will pay to feed a protein and mineral supplement when oat hay is fed as the only roughage. Protein and mineral supplements usually are not needed if oat hay is fed in conjunction with alfalfa hay or other legumes.

Timothy and Brome Hay

Timothy and brome grass hay can be fed satisfactorily in conjunction with a legume hay but are unsatisfactory as the sole roughage for young fattening stock unless protein and mineral supplements are fed. They may be fed as the sole roughage to mature fattening stock. When timothy hay is fed to sheep the heads of the hay work into the wool, irritating the skin and lowering the value of the wool. Both of these grasses should be cut for hay before they become mature if a good quality hay is to be obtained.

Crested Wheat Grass Hay

Crested wheat grass hay is not a highly palatable feed and is more suited as a feed for stock being wintered over rather than as a fattening feed. However, if grown in a mixture with alfalfa or fed in conjunction with alfalfa hay it can be fed satisfactorily to mature fattening stock.

Prairie and Upland Hay

The value of prairie and upland hay will vary depending on the species of grasses making up the hay and the stage of maturity of the grasses when cut. Like other grass hays prairie and upland hay is low in protein and minerals. The average prairie and upland hay obtained in southern Alberta makes a satisfactory feed for fattening yearling and two-year-old cattle and to a lesser extent for fattening lambs. Because of its low protein content it should be fed in conjunction with a legume hay, or a protein and mineral supplement should be included in the ration.

Silage versus Hay in the Feedlot

Within recent years much interest has been shown in putting up the hay crop as silage rather than as hay. One of the main advantages of preserving a crop as silage is that normally there is less loss in feed value than if put up as hay. This is especially so if the weather is unfavorable for haying. Unless the crop is ensiled at the proper moisture content (60 to 70 per cent) and unless the forage is well tramped, the losses, when ensiled, may be higher than when put up as hay.

The results of a number of experiments indicate that silage and hay of equal quality have the same feeding value for fattening cattle and lambs. If grain is fed in limited amounts and roughage in liberal amounts, better results will be obtained from a combination of hay and silage than from either one alone. However, if the amount of roughage fed is limited it will make very little difference whether it is fed as silage or as hay.

Usually 3 pounds of silage are equivalent in feeding value to 1 pound of hay.

Straw

The various cereal straws are, as a class, low in fattening value, low in protein, and low in mineral and vitamin content. Animals fed large amounts of straw cannot be expected to make rapid gains. However, if hay or other roughages are scarce, and grain and other concentrates are being fed liberally, often it is economical to feed a limited amount of straw to add bulk to the ration.

Oat straw is the best of the cereal straws for feeding purposes and if the oats were cut on the green side the straw may have considerable feed value. Feeding experiments conducted at Lethbridge to compare a ration of grain and equal parts of alfalfa hay and oat straw with a ration of alfalfa hay and grain when fed to two-year-old steers showed that oat straw had a replacement value almost equal to alfalfa hay in this ration. However, in another experiment when oat straw was fed to yearling steers it had practically no feed value. A small amount can be fed satisfactorily, especially to more mature livestock, if fed in combination with a high protein feed such as alfalfa hay and if grain is fed liberally. Large quantities of straw should not be fed with beet pulp and beet molasses unless protein and mineral supplements are fed since pulp and molasses also are low in protein and minerals.

Barley straw, from bearded varieties of barley, should not be fed to livestock as the beards often are the cause of sore mouths. Some of the newer varieties of barley that have a smooth beard are not so objectionable as the varieties with the rough beards but, nevertheless, must be fed with care. Barley straw from the beardless varieties is about equal to oat straw in feeding value.

Wheat and rye straw are unpalatable and low in feeding value and, therefore, should not be fed to fattening stock. It will return much more to the feeder if he uses all the available wheat and rye straw as bedding rather than as a feed.

Vegetable Canning By-Products

Peavine Hay and Peavine Silage

With the present acreage of canning peas being sown in southern Alberta there is a large volume of peavines available for livestock feeding each year. Peas are a legume crop, and like other legume forages the vines are rich in protein, calcium, and vitamin A. Either as hay or silage the vines are valuable in the fattening ration.

Figure 27.—Green peavines can be made into silage by stacking the vines as they come from the viner. Peavine silage is a very palatable and nutritious feed for fattening cattle and lambs.

Practically all the vines available in southern Alberta are made into silage, simply ensiling the green vines as they come from the viners in large stacks. This usually results in a good grade silage provided that proper care is taken to build a good stack. However, there is usually considerable spoilage on the top and sides of the stack.

From experimental findings and results obtained by practical feeders peavine silage or hay can be considered equal to medium-to-good quality alfalfa hay as a roughage for fattening lambs and cattle. Three tons of peavine silage are equivalent to approximately one ton of peavine or alfalfa hay in feed value. Many feeders have fed peavine silage as the only roughage along with grain and have reported very satisfactory results.

Sweet Corn Silage (Cannery and Refuse Silage)

With the introduction of corn canning into southern Alberta there is available each year a limited amount of sweet corn silage (silage made of the cob and husks after the kernels have been sheared off at the cannery). In chemcial composition this silage is very similar to the usual field corn silage. Feeding experiments conducted in the United States showed that sweet corn silage was approximately 75 per cent as valuable as ordinary field corn silage when fed to fattening steers. When fed as part of a well-balanced ration sweet corn silage is considered to have about 35 per cent the value of alfalfa hay, pound for pound. Like corn silage, sweet corn silage is low in protein and calcium and, therefore, for best results should be fed in conjunction with feeds that are relatively high in these nutrients.

Sugar Beet By-Products

In the sugar beet producing areas of southern Alberta the various beet by-products, if properly conserved and properly fed, constitute an economical source of feed for fattening cattle and sheep. None of the by-products, tops, pulp, or molasses, are by themselves balanced feed and if rapid and economical gains are to be obtained they must be fed in conjunction with other feeds that properly balance the ration. Any one or all three of the by-products are valuable additions to a ration of alfalfa hay and grain.

Beet Tops

The feeding value of sugar beets tops (which consist of the leaves, stems, and part of the crown normally removed in topping) has not been realized fully in southern Alberta. Each year many tons are wasted through improper usage. The tops are high in protein and rich in vitamin A if fed when green or if properly ensiled. However, they are much higher in mineral salts than most other feeds. This often is the cause of severe scouring among stock if tops are fed in too large amounts. Often the high mineral content is further aggravated by the inclusion of a large amount of dirt clinging to the tops. This not only lowers the value of the tops but also adds to their laxative effect.

Opinions differ among farmers as to the most economical methods of handling the tops so as to obtain the maximum feeding value with the least labor cost. Many farmers merely turn lambs or cattle, that later are to be finished in the feedlot, into the beet fields after the beets have been harvested. Stock so pastured often make satisfactory gains provided the weather remains dry but it is very wasteful of a valuable feed as a large percentage of the tops are trampled into the ground and wasted. During wet weather an even greater percentage is wasted and what is worse, livestock tramping on the wet land produces a soil condition that makes the preparation of a good seedbed the following spring difficult. Livestock trampling on the fields when the land is dry tend to pulverize the soil which increases the tendency for the soil to drift.

Figure 28.—Pasturing beet tops, especially during inclement weather, is very wasteful of a valuable feed, besides predisposing the land to soil drifting. (Photo, courtesy of United States Department of Agriculture.)

Figure 29.—Tops properly piled in the field to dry and later hauled to the feedlot for winter feeding provide a palatable and nutritious feed that is very valuable in the fattening ration. (Photo, courtesy of United States Department of Agriculture.)

Some farmers pile the tops into small piles in the field before turning the stock into the field. This too is very wasteful during wet weather but from the point of view of utilization of the tops is much more desirable than pasturing the unpiled tops.

Far greater feed value from the tops will be obtained if they are either piled in the field soon after topping and later hauled to the feedlot for winter feeding, or hauled off the field within 48 hours after topping and made into silage for winter feeding. Beet tops fed in the form of dry tops or silage provide a palatable and nutritious feed that will replace a considerable amount of other feeds in the ration.

The average weight of cured tops (30 per cent moisture) is usually between 250 and 300 pounds per ton of harvested beets. The yield of silage from a ton of beets also varies, but it is usually around 500 pounds per ton of harvested beets. Therefore, a field of beets yielding 12 tons of beets per acre would yield approximately $1\frac{1}{2}$ tons of cured beet tops or 3 tons of beet top silage.

The results of many feeding tests conducted at various agricultural experiment stations in the United States and Europe have shown that the cured tops from one ton of beets, if free from soil and properly handled, have a feeding value equivalent to about 25 pounds of grain and 95 pounds of alfalfa hay when added to a fattening ration. The feeding value of beet top silage per acre of harvested beets, if properly preserved and if free from soil, has a slightly higher value than the dried tops. Table V shows the approximate money value of the tops per ton of beets with grain and alfalfa prices at various levels.

Table V.—The Average Value of Sugar Beet Tops in Dollars per Ton of Harvested Beets for Fattening Lambs and Cattle with Alfalfa Hay and Grain Prices at Various Levels. Based on Replacement Values Determined in Feeding Trials.

Grain at (per ton)	Alfalfa Hay at (per ton)								
	$4	$6	$8	$10	$12	$14	$16	$18	$20
$10	0.32	0.41	0.50	0.60	0.70	0.79	0.88	0.98	1.08
$15	0.38	0.47	0.57	0.66	0.76	0.85	0.95	1.04	1.14
$20	0.44	0.54	0.63	0.72	0.82	0.92	1.01	1.10	1.20
$25	0.50	0.60	0.69	0.79	0.88	0.98	1.07	1.17	1.26
$30	0.56	0.66	0.76	0.85	0.94	1.04	1.14	1.23	1.32
$35	0.63	0.72	0.82	0.91	1.01	1.10	1.20	1.29	1.39
$40	0.69	0.78	0.88	0.98	1.07	1.16	1.26	1.36	1.45
$45	0.75	0.85	0.94	1.04	1.13	1.23	1.32	1.42	1.51
$50	0.82	0.91	1.00	1.10	1.20	1.29	1.38	1.48	1.58

The data in Table V also can be used to calculate the value per ton of dried beet tops and beet top silage. Multiplying the tabulated values by 7 gives the approximate value of one ton of dried tops and by 4 gives the approximate value of one ton of beet top silage.

Feeding values such as shown in Table V will be obtained only if the tops are fed in combination with a legume hay and grain or other concentrates. Because both legume hays and beet tops are high in protein they supply adequate protein for the fattening ration. Usually trouble from scouring is not encountered if the tops are fed in moderate amounts and if fed with alfalfa hay. However, if scouring does occur, it usually can be cured by feeding ground limestone or bonemeal daily at the rate of approximately one pound to every 10 head of cattle and one pound to every 100 lambs.

Beet tops are very palatable and, if they are self fed, livestock will often eat more than is good for them and will also waste a considerable quantity by pulling them out of mangers or through panels. Beet tops should be fed daily only in such quantities as will be cleaned up without waste. Sufficient manger space should be provided so that all animals can eat at one time as lambs or cattle will pull many tops through the panels or out of mangers and trample them if they are fighting for a space at the feeding manger. Lambs should be fed not more than about 1 pound of dried tops or about 2 pounds of beet top silage daily, and cattle not more than 8 to 10 pounds of dried tops or 10 to 20 pounds of beet top silage daily.

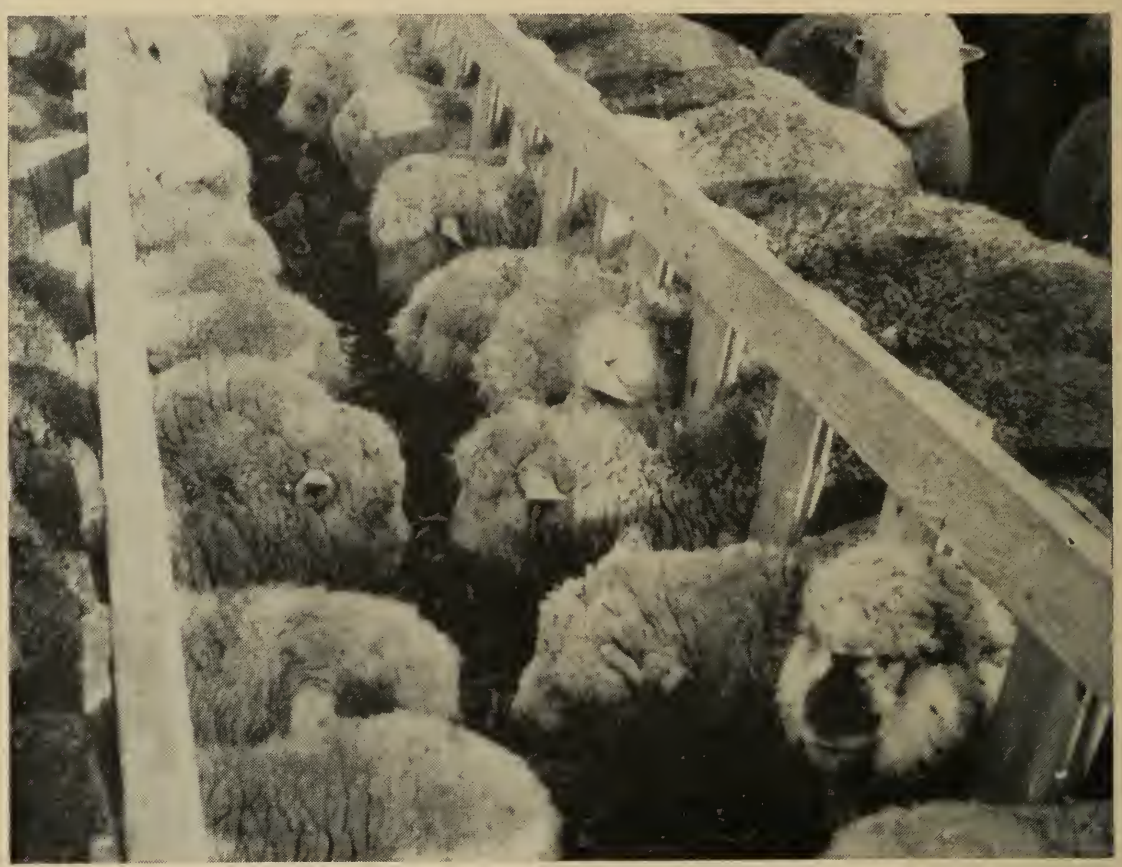

Figure 30.—Beet tops are a palatable and nutritious feed. The high feed value of this feed has not been fully realized in the past.

One of the best methods of ensiling the tops is to stack them green or slightly wilted (within 48 hours after topping) in large stacks above ground. The stack method of ensiling has proved as satisfactory as the use of a pit silo. No tramping or cutting of the tops is necessary in making the silage. However, care should be taken to build the sides of the stack straight and to keep the centers well filled. It also is important to have sufficient height to the stack. It should be at least 7 feet high when it has settled. The top of the stack should be rounded off so as to shed rain. The use of alternate layers of straw or hay throughout the stack is not recommended as this allows air to get into the stack with resulting spoilage. It should be strongly emphasized that tops with a considerable amount of dirt clinging to them should not be ensiled. It is much better to pile such tops and feed them as dried tops. In this way a considerable amount of the dirt will be shaken off in the handling and feeding of the dried tops. The poor gains and digestive disturbances sometimes encountered when beet tops are fed usually are traceable to the feeding of dirty tops.

With new topping machines now on the market and with the use of conveyors to load the tops directly into trucks a high grade beet top silage should be obtainable with a minimum amount of hand labor.

Wet Beet Pulp

Wet beet pulp is a very palatable feed for most classes of livestock. It is highly prized as a feed in the fattening ration because it stimulates the appetites of the fattening stock and largely prevents them going "off-feed". However, as wet pulp is a bulky feed of high water content its value per ton is low. Its moisture content varies from about 92 per cent in the fall of the year, when it first comes from the factory, to about 86 per cent the following spring. Therefore, a ton of pulp as purchased in the spring has almost twice the feeding value that it had the previous fall. Because of its bulky nature and low value per ton it cannot be hauled long distances economically. Most of the wet pulp is fed within a radius of 10 to 15 miles of the factories.

While wet beet pulp is a valuable feed in the fattening ration it has many deficiencies and must be fed in combination with feeds that correct these deciencies if the maximum returns are to be obtained from feeding it. It is very low in protein, minerals (calcium and phosphorus), and vitamin A. Alfalfa hay and grain together largely correct these deficiencies. Maximum returns cannot be expected if pulp is fed in combination with such feeds as straw, and non-legume hays, as these feeds are themselves low in protein, and minerals. However, these feeds can replace a part of the alfalfa hay and grain, without causing lower gains.

Mature cattle and old ewes often can be fattened successfully on a ration of wet beet pulp and alfalfa hay with only a limited amount of grain. Younger stock such as lambs, calves, and yearling cattle require a more liberal amount of grain if they are to reach a good market finish. Mature cattle will eat up to 100 pounds of wet pulp per head daily if grain is limited, while calves and yearling cattle will eat between 40 and 80 pounds per head daily. Old ewes will eat as much as 12 pounds per head daily and lambs from 6 to 10 pounds daily. However, unless grain prices are very high it seldom pays to feed such large amounts.

If good quality alfalfa hay is not available to feed in conjunction with the pulp a protein supplement should be fed, especially to calves, yearling cattle, and lambs. When alfalfa hay is fed as the sole roughage, it is not economical to feed protein supplements and when alfalfa hay and a fairly liberal amount of grain is fed there is no advantage from feeding mineral supplements.

Feeding experiments conducted at Lethbridge during the years 1931 to 1934, to determine the value of wet beet pulp when fed with alfalfa hay and grain to fattening lambs and calves, showed that each ton of pulp had a feeding value equivalent to 140 pounds of grain and 274 pounds of alfalfa. An average of these experiments and many others conducted in the United States shows that each ton of wet pulp has an average feed replacement value of 128 pounds of grain and 400 pounds of alfalfa hay.

There are other points that the feeder should keep in mind when feeding wet beet pulp. First is that, even though there is a large quantity of water in wet pulp, fattening stock always should be provided with drinking water. Another point is that fattening stock, if fed heavily on wet pulp right up to time of marketing, will suffer a heavy shrink in transit to the packing plants with the result that the buyer will either have to offer a lower price to cover this extra shrink or deduct a greater percentage shrink than commonly is deducted. It is a much sounder practice to feed pulp liberally during the first part of the feeding period and then gradually decrease the amount as fattening

progresses. No pulp should be fed the last two or three days before the stock are shipped to market. Still another point to consider is that fattening stock being fed wet pulp will require a more liberal supply of bedding than stock being fed dry feeds.

Dried Molasses Beet Pulp

Dried molasses beet pulp, like wet pulp, is a palatable, bulky feed that keeps stock in good physical condition and helps to prevent them going off feed. It has the same limitations as a feed as wet pulp in that it is low in protein and phosphorus content. A ration of alfalfa hay, grain, and dried molasses beet pulp makes an excellent ration for all fattening animals.

Studies carried out at Lethbridge with fattening yearling steers and lambs showed that when dried molasses beet pulp made up 25 per cent of the grain mixture 100 pounds of the pulp was equal in feeding value to between 110 and 120 pounds of grain (oats and barley). However, if dried pulp makes up more than approximately one-third of the grain mixture its value will be less than that found in these studies.

Beet Molasses

Beet molasses, a by-product of beet sugar manufacture, is a very palatable feed for livestock and because of this it is used mainly to improve the palatability of rations. Often it is used as a substitute for grain in the fattening ration, either self fed or mixed with grain, pulp, or hay. When fed in small amounts, and used to improve the palatability of the ration, it has a higher feed replacement value than when fed in large amounts.

The results of many feeding experiments with fattening cattle and lambs have shown that molasses when fed in moderate amounts has a feeding value equivalent to between 75 and 90 per cent that of grain.

Beet molasses is a laxative feed and, therefore, stock should be accustomed to it gradually and the amount fed should be limited. Not more than one pound per head daily should be fed to lambs and not more than 4 to 6 pounds daily to cattle. Beet molasses is deficient in protein and essential minerals (calcium and phosphorus) and so should be fed with feeds that overcome these deficiencies.

Miscellaneous Feeds

Cull Potatoes

Potatoes are grown extensively in certain irrigated areas of southern Alberta. Each year a considerable tonnage of small and off-grade potatoes (cull potatoes) unfit for sale, and occasionally surplus potatoes, can be disposed of profitably through livestock feeding. However, it should be remembered that potatoes are about 79 per cent water and thus are somewhat similar to silage. They are very low in protein, minerals, and vitamin A and, therefore, should be fed in conjunction with a legume hay or the ration should be supplemented with a protein and mineral supplement.

While it is advantageous to cook potatoes before feeding them to pigs there is no advantage in doing so when they are fed to cattle or sheep. However, to avoid the danger of their causing choking and to make them more palatable, they should be sliced or chopped before feeding. Spoiled potatoes, frozen potatoes, or potatoes with a large number of sprouts should not be fed as they may prove poisonous. The sprouts should be broken off before the potatoes are fed. Fattening cattle should not be fed much more than 20 to 25 pounds daily per head and lambs not more than 2 to 3 pounds daily per head.

In tests conducted at the Colorado Agricultural Experiment Station one ton of cull potatoes, when fed to calves at the rate of approximately 16 pounds per day with alfalfa hay, cottonseed cake, and ground barley in comparison with a ration of alfalfa hay, cottonseed cake, and ground barley, had a feed replacement value of 155 pounds of barley, and 350 pounds of alfalfa hay, but required 7 pounds more cottonseed cake. In another Colorado test one ton of cull potatoes when fed to calves had a feed replacement value of 236 pounds of barley, 3·9 pounds of cottonseed cake, and 409 pounds alfalfa.

In one study at the Lethbridge Experimental Farm with feeder lambs, 1 ton of cull potatoes had a feed value equivalent to approximately 480 pounds of alfalfa hay and 145 pounds of barley when fed at the rate of 2 pounds per lamb daily.

Cull Peas

Cull peas, that are not satisfactory for seed, make an excellent feed for fattening livestock. They are palatable and high in protein and, when fed to fattening lambs, they produce a firm finish.

Two experiments with cull peas conducted at the Idaho Agricultural Experiment Station showed that fattening lambs, which were fed a mixture of 20 pounds of cull field peas and 80 pounds of barley along with alfalfa hay, gained slightly more and had a better finish than another group fed only barley and hay. Each ton of cull peas was equal to 2,057 pounds of alfalfa hay and 1,371 pounds of barley. In cattle feeding experiments at the Montana Agricultural Experiment Station cull peas, when forming 20 per cent of the concentrate mixture, had a higher feed value than that shown for lambs. Because of the high protein value of peas they are very valuable in a ration that is somewhat low in protein.

Experience has shown that peas should not make up more than about 25 per cent of the grain mixture. They should be coarsely ground for cattle but should be left unground for sheep.

Pea Straw

Where peas are grown for seed purposes the pea straw may be used to advantage in the fattening ration. If other roughages are available pea straw should not be fed as the sole roughage. When fed with good quality alfalfa hay and grain, pea straw has been found to be worth 50 to 60 per cent as much as alfalfa hay.

Alfalfa and Sweet Clover Seed Screenings

Both alfalfa and clover seed screenings, consisting of small, shrivelled, and broken seeds, are a valuable addition to a lamb or cattle fattening ration. Their feed value will vary depending upon the amount of chaff and weed seeds that the screenings contain. They are high in protein and can be used in place of a protein supplement.

In two experiments at Lethbridge, legume seed screenings were equal in value to linseed oilmeal when fed to fattening lambs.

Alfalfa and Sweet Clover Straw

The value of the straw and chaff remaining after alfalfa or sweet clover have been threshed for seed will depend largely upon the amount of leaf retained and the manner in which it is cured. If there is a reasonable amount of leaf and the stems are not too coarse it can be considered to have a value of between 25 and 50 per cent that of good quality alfalfa. It should not make up the full roughage allowance but should be fed in conjunction with good legume hays or silages.

Corn Silage

Corn silage, like other silages, is appetizing and induces greater feed consumption resulting in faster gains. One ton of corn silage is considered equal to approximately one-half ton of legume hay when added to a ration of legume hay and grain. Corn silage is low in protein and, therefore, if fed in liberal quantities protein and mineral supplements should be added to the ration or else the silage should be fed in combination with feeds high in these nutrients.

Wheat Bran

Wheat bran, a by-product of the flour milling industry, is a palatable, bulky, slightly laxative feed, somewhat richer in protein than the cereal grains and very rich in phosphorus. Because of its palatability, bulkiness, and laxative nature it is a valuable feed to mix with grain when starting lambs and cattle on feed, but is usually replaced by less bulky feeds once the stock are up to a full feed of grain. However, if it can be purchased at a relatively low price a small amount can be included profitably in the grain mixture throughout the entire feeding period especially if oats are not being fed. Bran is about equal to oats, pound for pound, in fattening value, but because of its bulky nature it should not be fed in large amounts. It is a valuable feed to have on hand for animals that show signs of sickness or going off feed.

Flaxseed

Flaxseed generally is not used for livestock feeding because of its high commercial value in the linseed oil industry. However, when it is available for feeding it may be fed in place of linseed oilmeal. Flaxseed is very high in fat and lower in protein than linseed oilmeal. Because of the high fat content it is quite laxative, and must be introduced into the ration cautiously. When fed in moderate amounts flaxseed gives the animals considerable bloom besides stimulating their appetites.

Protein Supplements

It is essential that fattening lambs and cattle have sufficient protein in their ration for normal growth and development. Calves require a higher percentage of protein in their ration than do yearling cattle, which in turn require more than two-year-old cattle. Lambs require about the same percentage protein in their ration as do yearling cattle. Also, the protein requirement of thin feeder livestock is greater than that of feeders of the same age that have had good summer pasture.

The majority of feeds available for feeding in southern Alberta are low in protein content. Legume hays (alfalfa, sweet clover, and peavine) peavine silage, and sugar beet tops are the only home-grown feeds that contain appreciable amounts of protein. Unless these feeds make up at least one half of the roughage allowance insufficient protein will be provided for maximum and economical gains. If these feeds are not available for feeding a protein supplement should be fed. Most protein supplements fed at the rate of $\frac{1}{2}$ to 1 pound daily to cattle and one-tenth pound daily to lambs provide adequate protein.

Often, protein supplements, other than commercially prepared mixes, are not readily available from local feed dealers. However, when available, linseed meal, soybean meal, rapeseed meal, sunflower seed meal, cull peas, legume seed screenings, alfalfa meal, or brewer's grain are suitable protein supplements for cattle and sheep. These supplements vary considerably in the percentage of protein which they contain and, therefore, their price per pound of protein supplied should be the main consideration in deciding which is the most economical to feed.

Minerals

Certain mineral elements are necessary for normal animal life. Fattening animals that receive an insufficient amount of these essential minerals will not make rapid and economical gains. All livestock require salt. It should be accessible to them at all times in a separate trough. Of the many other minerals required by livestock, calcium and phosphorus are the only ones that normally are found to be deficient in the fattening ration. Legume hays, such as alfalfa, sweet clover, and peavines are very rich in calcium while the grass and cereal hays are only fair sources of this element. If at least one half of the roughage allowance is a legume hay it is unlikely that the addition of a calcium supplement will improve the economy of gains. If a legume hay is not fed a mineral supplement, such as ground limestones or bonemeal that is high in calcium, should be fed.

All legume hays and other hays are deficient in phosphorus especially if grown on soil deficient in this mineral element. Beet pulp and beet molasses are also deficient in phosphorus and, if either or both of these feeds are being fed, special attention should be given to see that adequate phosphorus from other sources is supplied. Fortunately, the cereal grains (barley, wheat, oats, and rye) are fairly rich in phosphorus and thus make good the deficiencies of the other feeds for this element. However, cereal grains seldom are fed in liberal amounts during the early part of the feeding period while the phosphorus-deficient feeds (hays and beet by-products) are fed in large amounts during this time. Therefore, a mineral supplement, such as bonemeal that is relatively high in phosphorus, should be made available to fattening cattle and sheep during at least the first month that they are on feed. The need for a mineral supplement during the first month of feeding is even greater if the feeder stock have come off poor summer pasture. Feeder stock coming into the feedlot suffering from a mineral deficiency will not make good gains until this deficiency is corrected.

Experiments have shown that, provided both alfalfa hay and grain are fed in liberal amounts, there are no advantages in feeding mineral supplements. However, as pointed out previously it is always a wise policy to feed a mineral supplement that is high in phosphorus during at least the first month that the stock are on feed.

A satisfactory mineral mixture for fattening cattle or lambs, if a legume hay is not being fed, is one composed of the following:

25 pounds of ground limestone
25 pounds of bonemeal or mono-calcium phosphate
50 pounds of salt.

If a legume hay is being fed the limestone may be omitted from this mixture. There are also many satisfactory commercial mineral mixtures on the market. In buying a commercial mineral mixture the aim should be to buy one that contains a high proportion of the mineral elements needed by the livestock. Even if salt is contained in the mineral mixture being fed a separate trough containing only salt also should be provided.

Cattle usually will consume less than 12 pounds of minerals and about 15 pounds of salt per head during the fattening period if fed to them free-choice. Lambs will consume about one-tenth of these amounts.

THE NEED OF VITAMIN A IN THE FATTENING RATION

Experience and experimental findings have shown that an animal's resistance to infection and disease is greatly reduced if it is deficient in vitamin A. The usual signs and symptoms of a vitamin A deficiency as they appear in cattle are night blindness (the inability to see well in a dim light); a lack of normal alertness; a staggering gait; convulsive seizures; watery discharges from the eyes; nasal discharges; swelling or puffiness of the legs and hocks; loss of appetite; a rough, dry hair coat; and finally death if the condition is not relieved.

Figure 31.—A steer showing the typical symptoms of Vitamin A deficiency. Note the wateriness of the eyes, the rough hair coat, and the lack of normal alertness.

While such advanced stages of vitamin A deficiency seldom are found in the average feedlot, many cattle and possibly lambs are deficient in vitamin A to the extent that their resistance to infection and their ability to make maximum use of their feed is impaired. Most mature livestock that have had good summer pasture normally have a sufficient reserve of vitamin A stored in their body to meet their needs throughout the average feeding period even if their ration contains very little or no vitamin A. However, calves do not have a sufficient reserve of vitamin A in their body to carry them through the normal fattening period. It is important that careful thought be given to the vitamin A content of the fattening ration.

Legume hays and beet tops are excellent sources of vitamin A if they have been cured without too much exposure to rain and the weather. Hay that has been rained on in the field or that has burned or molded in the stack will contain little vitamin A. The grass and cereal hays, if cut for hay before they mature and if properly cured, also are fair sources of vitamin A. On the other hand mature or improperly cured hay, straw, beet pulp, beet molasses, and grain contain very little and in most cases no vitamin A.

If the fattening ration contains a legume hay or silage, beet tops, or even well cured green cereal or grass hay, sufficient vitamin A will be supplied to meet the normal requirements of fattening cattle and lambs. On the other hand, if the feeder stock have had poor summer pasture consideration should be given to supplying extra vitamin A. Vitamin A can be purchased as fish liver oils or in dry powdered forms.

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